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ORIGINAL ARTICLES

A CONTRIBUTION TO THE MECHANISM OF GROWTH OF THE HUMAN FACE*

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IN THE spring of the present year the two authors found that they were investigating the same problem—namely, the growth of the face in childhood and youth—by different methods. While one (G. C.) was measuring the amount of growth which takes place at succeeding age periods, the other (A. K.) was seeking to determine by the study of immature and mature skulls the sites at which such growth takes place. Both authors are and were of opinion that the entire face is essentially a part of the apparatus of mastication and that irregularities of the jaws, in size, shape and position, can be explained only when a study is made of the ingenious and elaborate mechanism which underlies growth of the face as a whole. The authors have consequently pooled their results.

For measurement of the forward growth of the face—growth forward in a sagittal plane—the external auditory meatus has been taken as a base from which to estimate the forward movement of various points between forehead and chin. Sutural lines at which this advance takes place involve not only those lying in the face, but particularly those situated in the base of the skull and in the lateral wall of the skull. Growth of the face in height, as measured from the nasion to the lower margin of the chin, is confined to sites and sutures of the face, as above defined. In the opinion of one author (A. K.) the supraglabellar depression marks the upper limit of the masticatory face, but unfortunately its limits are so often imperfectly marked that it has not been included in our measurements. In the present paper the side

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to side or lateral increase of the face is only dealt with by one author (A. K.). In his opinion the most frequent derangements of growth, seen in modern English faces, is due to a deficiency or alteration in the lateral expansion which ought to take place in normal children. The most important suture involved is that between the maxilla and malar or jugal bone on each side of the face. Evidence will be adduced for believing that the median sagittal

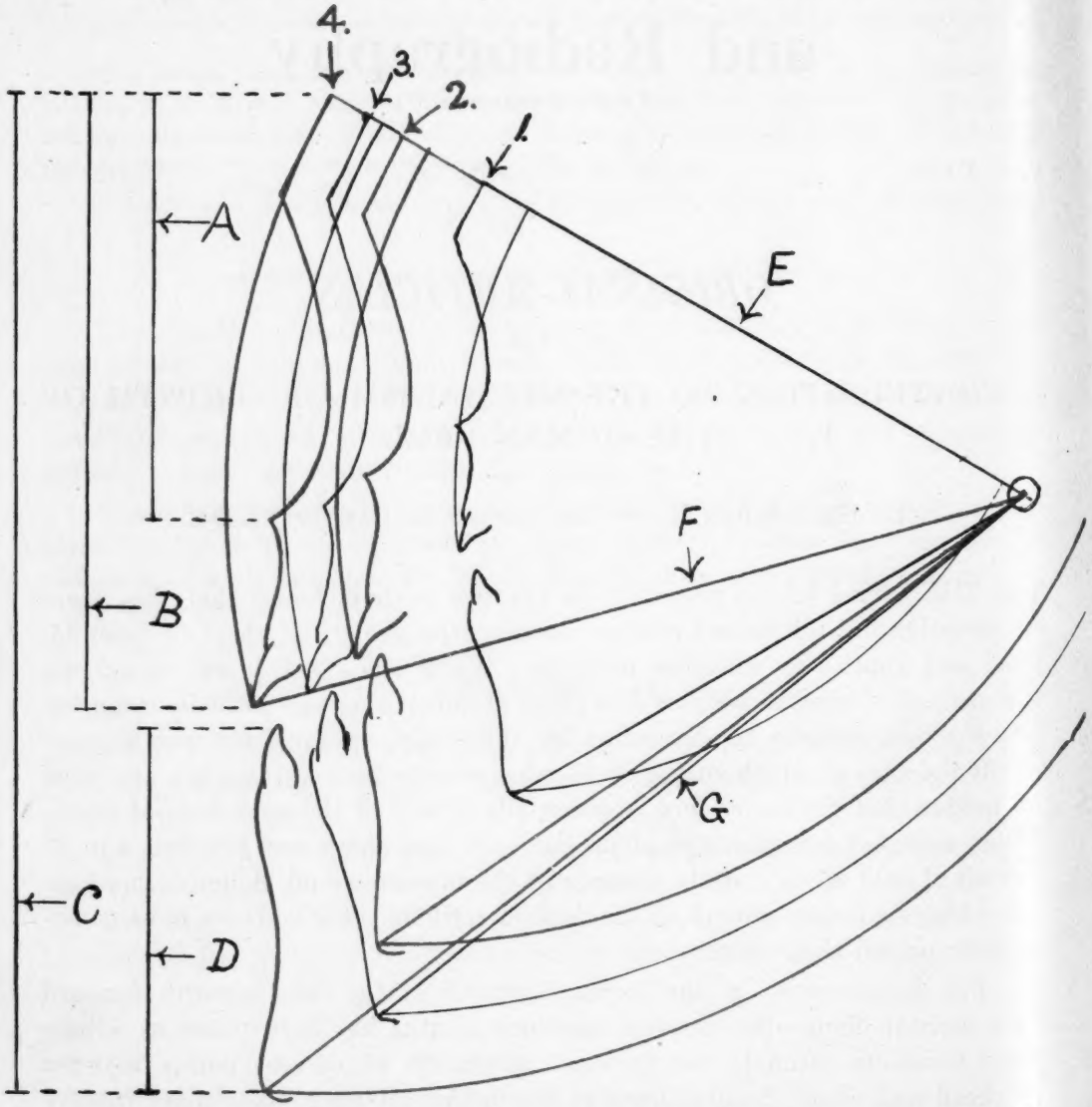

Fig. 1.—Diagram, showing vertical and forward growth of the normal or subnormal face. Vertical measurements taken from nasion, forward measurements from trans-meatal axis. The arcs centered at the meatal axis show the progressive growth forwards along line F in relation to that along line E. The arcs centered at the nasion show the progressive vertical growth along line C in relation to that along line E.

suture of the palate takes a very active part in adding to the palatal width. There are also reasons for believing that the bone-substance which surrounds dental buds and sacs, as well as tooth sockets, is controlled by a mechanism which differs from that regulating bone growth in the rest of the face. Further, it will be shown that the distance beween one temporo-mandibular joint

and another is dependent on growth at the base of the skull. The width of the base of the skull and of the face is increased by bone being laid down in the spheno-temporal suture. The base of the skull is transformed in size and conformation between the 5th and 18th years to a much greater degree than is usually realized. Lastly, it will be demonstrated that the acromegalic face is enlarged by a process of true growth.

Profile 1. From child age 3 years and 6 months
" 2. Represents mean of 10 children aged 9-11 years.
" 3. " " 9 " " 15-16 "
" 4. " " 10 adults (Campion).

TABLE I

MEAN AND STANDARD DEVIATIONS (CAMPION).

Vertical Growth.

		9-11	15-16	ADULT
A.	Nas. to Sub-nas. point	42.9±2.55	49.3±2.26	53.2±3.75
B.	Nas. to Upp. Inc. ..	64.0±2.19	72.6±4.11	76.7±4.56
C.	Nas. to Sub-mental point	100.1±2.60	111.4±5.49	122.8±7.67
D.	L. Inc. to Sub-ment.point	35.8±1.17	40.8±1.83	44.7±3.34

Forward Growth.

		9-11	15-16	ADULT
E.	Trans-meatal axis to Nas.	89.9±4.1	95.6±3.16	100.4±3.87
F.	Trans-meatal axis to Inc.	86.6±2.97	94.0±4.29	100.6±6.36
G.	Trans-meatal axis to Mental eminence ..	98.6±3.67	104.3±4.9	119.9±8.65

In Fig. 1 are summarized the results obtained by measurements made on the living face—the number of individuals included being mentioned in the legend to the illustration and the means of the measurements reproduced in Table I. The first question we seek to answer on this paper is: How does the forward growth of the face take place? The advance is measured from the trans-meatal axis or line—one passing through the center of the ear passage on each side of the head. We shall take first the advance of the nasion, which is moved in a forward direction owing to new bone being laid down somewhere along the line *E* (*E*, Fig. 1). The points at which such bone is laid down may be seen in Fig. 2, where a sagittal mesial section of a child's head, aged 5 years, is superimposed on a corresponding section of a skull of an Englishman with a well-formed face, with dimensions rather above the average. The superimposition has been made so that pituitary fossa falls on pituitary fossa, and cribriform plate on cribriform plate, because a prolonged experience has shown one of us (A. K.) that the pituitary or sphenoid region serves best as a fixed point in comparing the development or growth of one skull with that of another.

As represented in Fig. 2, the nasion has advanced by growth from a point 73 mm. in advance of the trans-meatal axis in the 5th year (*A*) to one 96 mm. in advance, in the adult *B*; in the space of some sixteen years 23 mm. of additional bone has been laid down at various points along line *E*; 5.7 mm. of new bone is laid down in the forward line *E* from the 10th to the 16th year, 4.8 mm. being laid down after the 16th year. The length of the line *E* on newly-born children is about 48 mm.—but the exact amount must be de-

termined—not in the dried skulls at our disposal, but in moist skulls, with the cartilaginous parts unshrunken. Broadly speaking, the line *E* is doubled in length by the growth which takes place from birth to adult age. From the standard deviations given in Table I, it will be seen that the line *E* is the least variable of the three forward measurements.

In Fig. 3 is given a diagrammatic analysis of the sites of growth along line *E*. Growth occurs at three sites in the basal part of the "*E*" or naso-

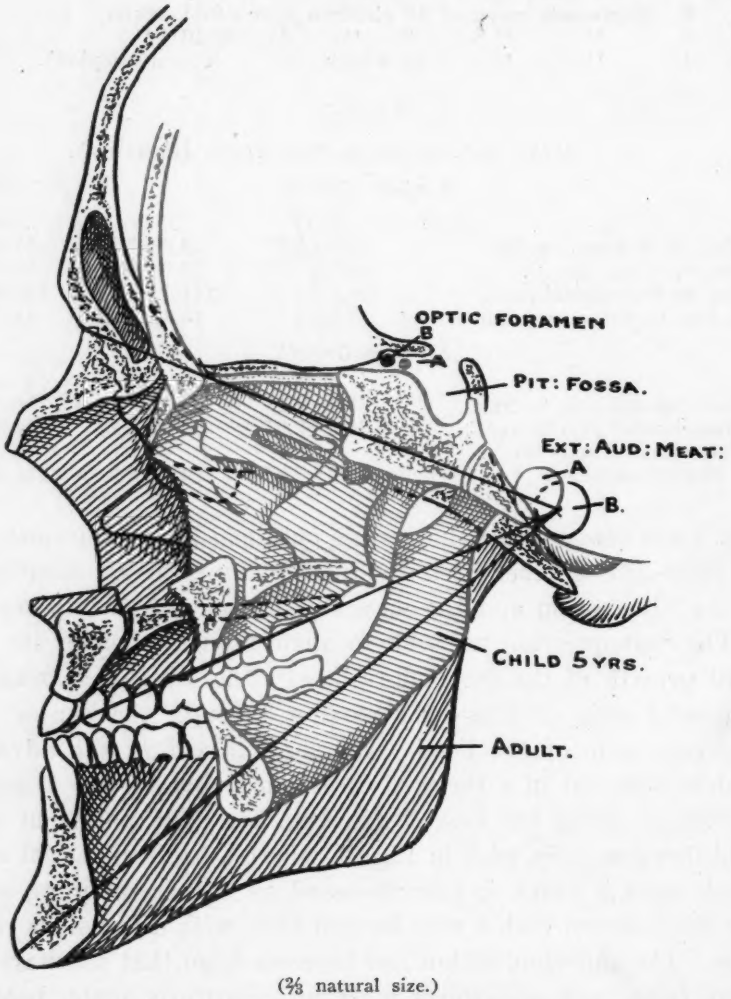

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Fig. 2.—A: Sagittal mesial section of skull of child with M^1 about to erupt, and estimated to be five years of age. B: Corresponding section of skull of adult Englishman. The skulls are superimposed so that the pituitary fossæ and cribriform plates correspond. The sections show the amount of growth in the sagittal mesial plane from the 5th to the 25th years.

meatal line, viz., at the fronto-nasal site (*A*); spheno-ethmoidal junction (*B*) and at the spheno-occipital junction (*C*). In the samples chosen, the nasion has been advanced 23 mm. from the 5th to the 21st years; 7 mm. has been obtained by deposition or addition to the outer surface of the naso-glabellar region of the frontal, and by the formation of the frontal sinuses; 10 mm. have been interpolated at the spheno-ethmoidal junction; the remainder 6 mm. at the spheno-occipital junction.

Taking these sites of growth in the order shown in Fig. 3 we see that at the fronto-nasal region (*A* in Fig. 3) the nasion, in the samples chosen, has moved in an upward and forward direction to the extent of 11 mm. from the 5th to the 25th years. The cribriform plate was taken as a fixed base from which to measure the upward movement of the nasion. This upward movement at first surprised us, but on further investigation we find this to be the rule in modern English skulls, but in the skulls of primitive native races and in prehistoric English skulls this upward movement is usually replaced by one in a forward, often combined with a downward direction. The important point to note is that this naso-glabellar addition has nothing to do with growth of brain; it is directly related to the development of the masticatory apparatus; the supra-orbital and glabellar regions of the frontal bone are intrinsic parts of the bony scaffolding on which the maxillæ are set and from which the muscles of mastication exercise their power. The bone laid down at this site is a superficial deposit on the naso-glabellar surfaces of the frontal

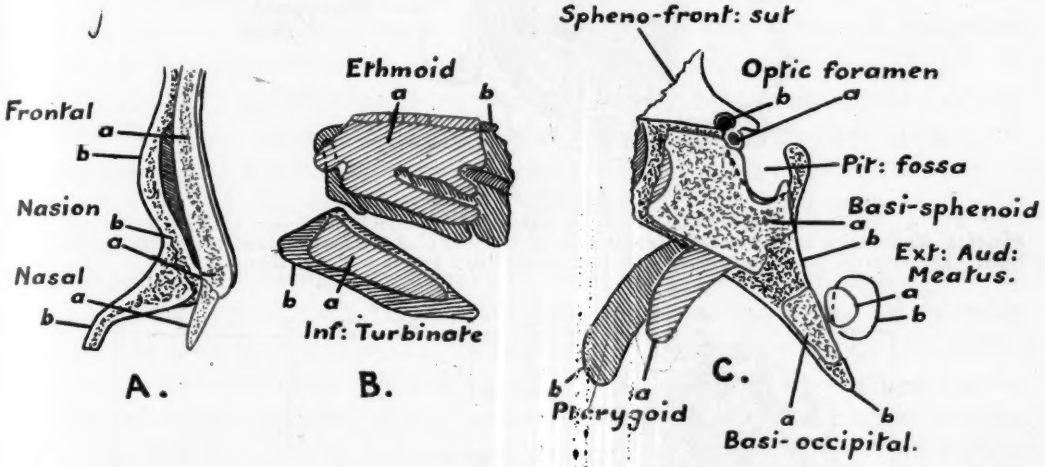

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Fig. 3.—Sites of growth along line E in basal parts of skull (a) child, aged five (see Fig. 2); (b) adult (see Fig. 2). A: Fronto-nasal element; B: Ethmoidal element; C: Sphenoidal element.

and nasal bones. The upward and forward growth of the nasion gives the high frontal root to the nose seen in the classical statuary of ancient Greece.

The amount of growth at the fronto-ethmoid junction (*B*, Fig. 3) appears to be very restricted, but it is otherwise at the spheno-ethmoidal junction. This suture is concerned not only in the growth of the face, but also in the increase of the nasal cavities and particularly of the brain space. At this junction growth takes place by the transformation of cartilage into bone; as we shall see later, it is part of the great coronal system of cranial growth-sutures—a system involved in facial as well as cranial growth. Our chief interest in the spheno-ethmoidal suture at the present moment is because it is concerned in providing space for the erupting maxillary molars. About thirty years ago,* one of us (A. K.) showed the importance of the pterygo-

*"The Relationship of the Eruption of the Permanent Molar Teeth to the Expansion of the Maxillary Sinus."—*British Jour. Dental Sc.*, 1902, vol. 45, p. 529.

maxillary suture during the growth of the upper jaw and the eruption of the upper molars. One of the illustrations then published is reproduced here (Fig. 4). A glance at Figs. 3*A* and at Fig. 4 shows that the spheno-ethmoidal cartilaginous junction and the pterygo-maxillary fissure are parts of the same coronal sutural system—one where additional alveolar and maxillary space is obtained during the eruption of the permanent molars. It is true that in the disorders of growth known as achondroplasia (2), and also in another disorder, acrocephaly, there is a profound arrest of growth in the spheno-

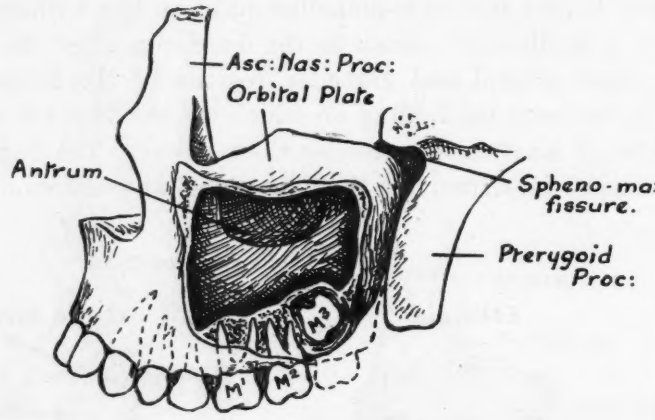

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Fig. 4.—Sagittal section of the maxilla of male aged nineteen, with crown of third molar still unerupted. The growth of the alveolar border and the position of M^3 when in place, are shown by stippled lines. The external pterygoid process and pterygo-maxillary fissure are also shown.

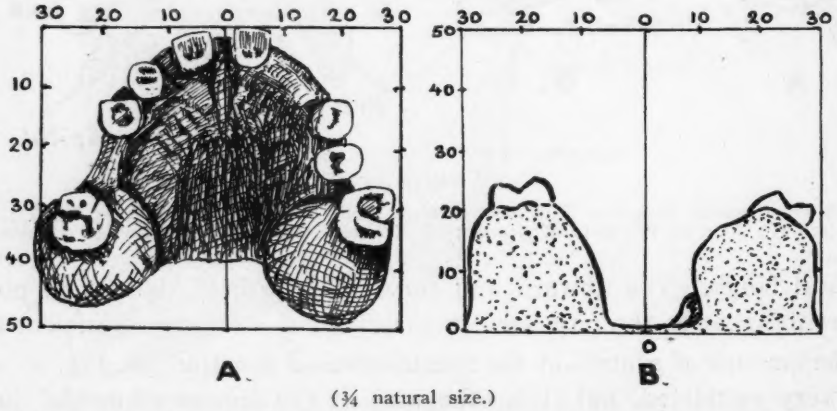

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Fig. 4*A*.—Drawing from cast of palate of young woman. B represents a coronal section at sites of alveolar enlargement.

ethmoidal junction without any failure in the development of the molar part of the maxilla. In achondroplasia the maxillary part of the face undergoes the rotatory movement so well illustrated in the snub-face of the bull-dog, and thus obtains molar space; in acrocephaly (2) compensation is got in another way.

The important part taken by the pterygoid process in the machinery of facial growth in a forward direction is indicated in Fig. 3*C* and Fig. 4. From the 5th to the 35th years, in the samples chosen in Fig. 3*C*, the lower

part of the pterygoid process has extended in a forward direction to a distance of 9 mm. and in a downward direction to about an equal extent. During the years of growth the pterygo-maxillary fissure is being moved forwards, which indicates that the maxilla as a whole must also be moved. Throughout this period, too, new alveolar bone is being laid down in the molar alveolar region, immediately in front of that part of the pterygo-maxillary fissure which is occupied by the tuberosity of the palate bone. There is a class of case, a fine example of which is at present under the observation of Sir Francis Farmer, where there is no forward movement of the maxillæ, the alveolar bone, which should have formed the sockets for the upper 2nd and 3rd molars being heaped up as a mass on each side of the palate in front of the lower or palatal ends of the pterygoid processes.

We now come to the third of the deep sites involved in the growth along the line *E* (Figs. 1 and 2). The growth in the spheno-occipital cartilaginous junction, from the 5th to the 25th year is about 9 or 10 mm. in extent (see Fig. 3*C*), but not more than 5 or 6 mm. are added to the extent of the naso-meatal radius. For this reason: the growth at this suture is concerned chiefly in giving pharyngeal space—space for breathing and swallowing. It will be noted (Fig. 3*C*) that this growth junction lies in front of the external auditory meatus; growth at the junction leads to a displacement of the temporal bones and ear passages in a backward and downward direction; there may also be a forward movement of the sphenoid, but in a system of relativity, such as the growing skull is, it is most convenient to regard the body of the sphenoid as a fixed basis which, for practical purposes, it is. The increase at the spheno-occipital junction thus increases the *E* line by carrying the meatal base backwards and downwards to an average extent of some 5 or 6 mm. Space is thus obtained for growth of mandible, throat and mouth. In achondroplasia, growth at this suture ceases at birth or soon after, a series of compensatory growth mechanisms being brought into play to give the needed pharyngeal space.

So far we have merely examined and illustrated the *deep* sites of growth concerned in the increase of line *E*; the more superficial sites concerned we can examine more conveniently at a later stage. We now turn to the sites of growth concerned in line *F* (Fig. 1), where the increase is estimated by measuring from the transmeatal axis to the incisive margins of the upper central incisors. The structures and sutures involved in this line are represented in Fig. 2, while in Fig. 5 an analysis is given of the amount of increase at the various sites of growth along the line. As may be seen from Table I, the incisive margins of the upper central incisors were 86.6 mm. in front of the trans-meatal axis in the 10th year; by the 16th year they had reached 94.0 mm., an increase of 7.4 mm. in six years, while the point reached in the final period of advance was 100.6 mm., showing an average increase of 6.6 mm. during the later years of adolescence—the years in which the 3rd molars were, or should have been, erupting. One very interesting point is brought out by this table of measurements. At the 10th year the *F* line showed a much greater degree of stability than the *E* line

as measured by the standard deviation; but by the 16th year matters had become reversed; in the individuals measured, the *F* line fluctuated in its dimension much more than the *E* line; some growth factor had come into operation in the "*F*" line, which varied greatly in its incidence, being great in one individual and small in another. This difference in variability becomes even greater in the later stages of growth; the standard deviation for *F* is nearly twice that for *E* in adult skulls. Why this variation should mark growth along the line *E* will become apparent as we proceed.

In Fig. 2 the central incisor crowns lie 73 mm. from the trans-meatal axis in the skull of the 5-year-old child; 106 in the adult. In the samples chosen the incisor crowns have been advanced 33 mm. In Fig. 5 the points at which this increase is obtained are shown. By far the greater amount—about 16 mm.—as is seen in Fig. 5, is obtained by addition at the posterior area of the maxilla—the area lying in front of the pterygo-maxillary fissure, where the molar part of the alveolar margin is produced. The eruption of

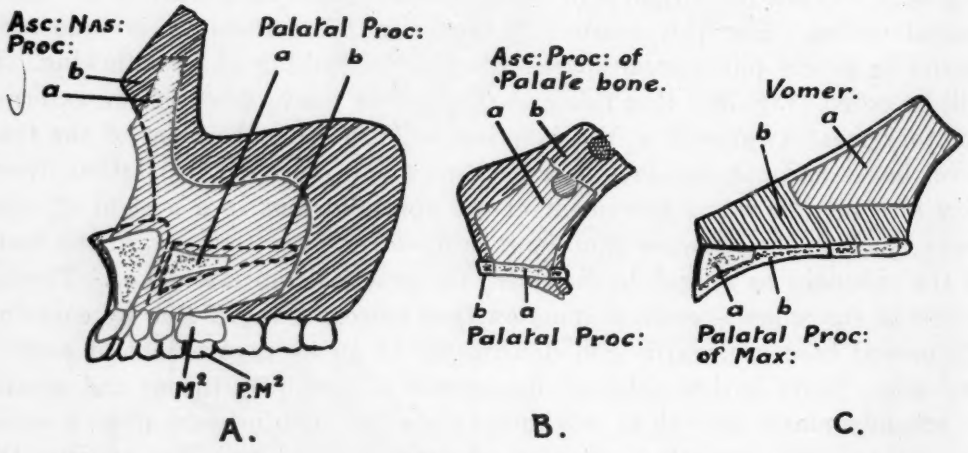

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Fig. 5.—Analysis of growth-sites along line F: A, Maxilla (a), mesial aspect of a child aged five, superimposed on maxilla (b) of adult (same skulls as are represented in Figs. 2 and 3); B, Palate bone (a) of same child superimposed on adult bone (b); C, Vomer and palate (a) of child superimposed on corresponding parts of adult (b).

the permanent incisors extends the *F* line about 5 mm. in a forward and downward direction (Fig. 5*A*). The other sites and structures concerned in the increase of this line have been mentioned already—the forward extension of the pterygoid prop, and the growth at the spheno-occipital suture producing a backward movement in the meatus. The great variability in the length of the line *F* depends very largely on the amount of bone laid down in the molar part of the maxilla and on the forward extension of the pterygoid prop.

The reader will observe in Fig. 5*A* that in superimposing the 5-year-old maxilla on the adult specimen we have taken the naso-palatine canal as the most fixed point, placing premaxilla on premaxilla, and the palatal plate of the maxilla on the corresponding element. At this point the question may be raised: is any point of the growing maxilla more fixed than another? Everyone will agree that the molar region of the adult jaw—the

alveolar areas with the superimposed part of the maxillary sinus—are parts which come into existence as the molar crowns are developed and come into use. We do not maintain that the naso-palatine canal is absolutely fixed but the palatal area in its neighborhood is the part which is least altered during growth.

The growth of the palate bone, which also helps in the forward growth of the incisor area, is shown in Fig. 5*B*, the new bone being apparently added at its posterior as well as at its anterior margin. In Fig. 5*C* the growth of the vomer is shown; bone has to be laid down in the vomer, chiefly along its palatal or lower border, to keep time with the maxillary growth in front of the pterygo-maxillary fissure. The buckling of the septum of the nose is due, in part at least, to a lack of harmony in growth at the maxillary and septal sites. One point, shown in Fig. 5*C*, we would draw particular attention to: it is the importance of the transverse palatal suture—the suture in the bony palate between the maxillary and palatal elements. Bone is laid down in this suture at even a greater rate than at the posterior aspect of the maxilla. Growth at this suture has to keep time with the maxillary increase. In Fig. 5*C*, 18 mm. of new bone is shown as having been interpolated at the transverse palatal suture between the 5th and 25th years, three-fourths of the addition being made on the maxillary side of the suture. Thus it will be seen that the forward growth along line *F* involves a series of growth sites and demands the existence of a hormone or growth regulating system to coordinate the rate of increase at the diverse points of increase.

Here, too, we must call attention to a phenomenon which seems to have escaped observation hitherto—the process of absorption or remodelling which affects the nasal aperture and ascending nasal processes during the period of growth. In Fig. 5*A*, an anterior margin of the nasal aperture is seen to rise from the premaxillary element close behind the nasal spine at the 5th year, whereas in the adult it springs from the premaxilla just in front of the line of the naso-palatine canal. We have seen that the naso-palatine may be regarded as a fixed region; it is not the premaxillary element that has moved forward but the ascending nasal process which has been cut back. The process is identical to that seen in the ascending ramus of the mandible; while new bone is being laid down on the posterior border of the body of the maxilla, old bone is being absorbed from the margins of the pyriform or nasal aperture. As regards the ascending process of the maxilla— the process interpolated in the root of the nose, between the lachrymal behind and the nasal bone in front, new bone is laid down at all its margins (see Fig. 5*A*).

We here touch on the other series of the lines of measurements given in Table I, those along which growth is estimated in a vertical direction. Two of these we will refer to here in the briefest manner: the lines *A*, from nasion to sub-nasal point (Fig. 1), and *B*, from nasion to incisor crown (Fig. 1). At the 10th year the mean length of line *A* measures 42.9 mm.; by the 16th year, 6.2 mm. has been added; at full growth, the line reaches 53.2 mm. only 3.9 mm. being added in the later years of growth. The total

increase from the 10th to the 25th years, is 10.3 mm.; the specimens represented in Fig. 2 indicate an increase of 14 mm. on line *A* from the 5th to the 25th years. A glance at Fig. 5*A* shows that this increase, so far as concerns the outer aspect of the face is almost entirely confined to the growth of the ascending nasal process; but there is, in the depth of the fact, a pronounced increase in vertical height of the body of the maxilla—the part enclosing the maxillary sinus. Also there is an increase in the vertical height of the septal and lateral walls of the nasal cavities, which is not easily estimated in the living (Fig. 5). New bone is being constantly formed in the maxillary floor of the orbit—in the roof of the maxillary sinus, leading to a thrusting downwards of the body of the maxilla and palate. As shown in Figs. 5, *B* and *C*, there is a corresponding growth on the vertical plate of the palate bone in the region of the spheno-palatine canal—and another along the lower border of vomer and vertical plate of ethmoid, leading to a downward and forward thrust of the palate. The vertical increase in the body of the maxilla and corresponding nasal parts is about 8 mm. from the 5th to the 25th years.

In line *B* another element becomes included—the growth of the alveolar part of the maxilla. It is not necessary to go into all the reasons which have led us to regard the alveolar part of the maxillæ—the part which lies below the level of the hard palate and forms the bony sockets for the teeth—as a distinct growth element, a plastic element regulated by its own independent growth system. The height or length of the face, particularly of the upper face, depends largely on the manner in which alveolar growth takes place. In Table I the length of line *B*, from nasion to central incisor crown, measures 64.0 mm. at the 10th year, 72.6 mm. at the beginning of the 16th, 76.7 mm. in adults; the fluctuations in height become greater the older the group of children examined. The difference between the lengths of the *A* and *B* lines represents the depth or height of the premaxillary part of the jaw; at the 10th year the premaxillary element measures 21.1 mm.; at the 16th year 23.3 mm.; in adult life 23.5 mm.; there is thus, after the eruption of the permanent incisors, only a slight increase in the height of the alveolar region of the maxilla. On the other hand there is a marked increase with the eruption of the permanent incisors (see Fig. 5*A*).

This is the most convenient point at which to introduce a common and remarkable conformation of the subnasal region of the premaxillary, one which is seen in quite 10 per cent of modern English skulls to the degree represented in Fig. 6. One palate, *A*, is of the primitive type, with wide, flat palatal plate, the alveolar borders being well apart and regularly developed. The other is a narrow contracted arched palate with high or deep alveolar margins. The two are superimposed so that the naso-palatine and palatal regions correspond. In the latter skull the nasal spine is very projecting and depressed, while the margins of the nasal or pyriform aperture have grown so as to separate the floor of the nose from the face by a sharp, deep ledge of bone. The alveolar margins in this skull are deeper than usual, particularly in the premaxillary region—the crown of the central incisor

being 12 mm. lower than in the normal palate. This modern derangement of growth is almost confined to the alveolar element of the maxilla, leading to an increase of the "*B*" line by 10 or 12 mm. The length of the dental arch in profile, as seen in Fig. 6, is 6 mm. longer than in the normal palate. Thus increase in the direction of the line *B* may not be the result of a normal but of an abnormal growth. We shall see that with this abnormal increase in height of the upper face, there is a marked reduction in width measurements.

So far we have been dealing with sites of growth lying deep within the skull, situated on or near its mesial vertical sagittal plane. We now turn to the superficial sites and sutures concerned in the forward extension of lines *E* and *F* (Fig. 1). In Fig. 7 we have treated the trans-meatal axis as if it were a fixed and not a movable base; its movement does not alter the estimate of growth at the various sites. The first growth suture we direct attention to is that situated in the zygomatic arch, between the temporal and malar elements. This suture, it will be observed, lies directly over the pterygo-maxillary fissure in front of which new maxillary bone is added. It

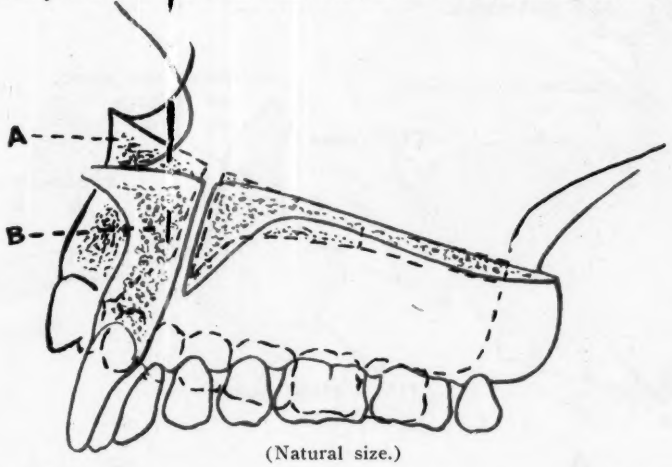

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Fig. 6.—Sagittal mesial section of a palate, showing a marked degree of narrowing or contraction (B), superimposed on a wide well-developed English palate (A). Both from male skulls.

will thus be seen that the temporo-malar suture is part of the great coronal system—including the coronal suture itself, the fronto-sphenoid (Fig. 3*C*) the spheno-ethmoidal (Fig. 3*C*), the pterygo-maxillary (Fig. 7*A*) and the transverse suture of the palate (Fig. 5*C*). The addition at the temporo-malar suture from the 5th to the 25th years is about 16 mm., being equal, in an antero-posterior direction to the amount laid down on the posterior region of the maxilla. In the growth of the face the rate of increase at all of these sites must be regulated by a coordinating mechanism.

At the malo-maxillary suture, although a great addition is made leading to increase of width of face, only a few millimeters are added so as to give a forward growth in the direction of lines *E* and *F*.

In Fig. 7*A* the addition made in the region of the pterygo-maxillary fissure between the 5th and 25th years is again shown, this time from the lateral aspect. The superimposition adopted in Fig. 7*A* brings out the alveolar growth at the eruption of the permanent incisors. The cutting back of

the margin of the nasal aperture and the growth of the ascending nasal process, as seen on the lateral aspect of the face, are also brought out. We would direct special attention to the remodelling and backward movement of the malar process of the maxilla. In the 5th year it occupies a forward position in the flat face of the child; in adult years it has been shifted back by a process of remodelling—absorption on its facial surface with addition to its posterior or zygomatic surface. So far we have not met with any mention in published literature relating to this growth-transformation in the cheek region of the child's face.

As regards additions made to the vertical height of the face little need be said so far as concerns the parts shown in Fig. 7. The increase in height and breadth of the ascending nasal process of the maxilla has already been described; here we call attention to the growth of the corresponding process in the outer or lateral wall of the orbit—the frontal process of the malar.

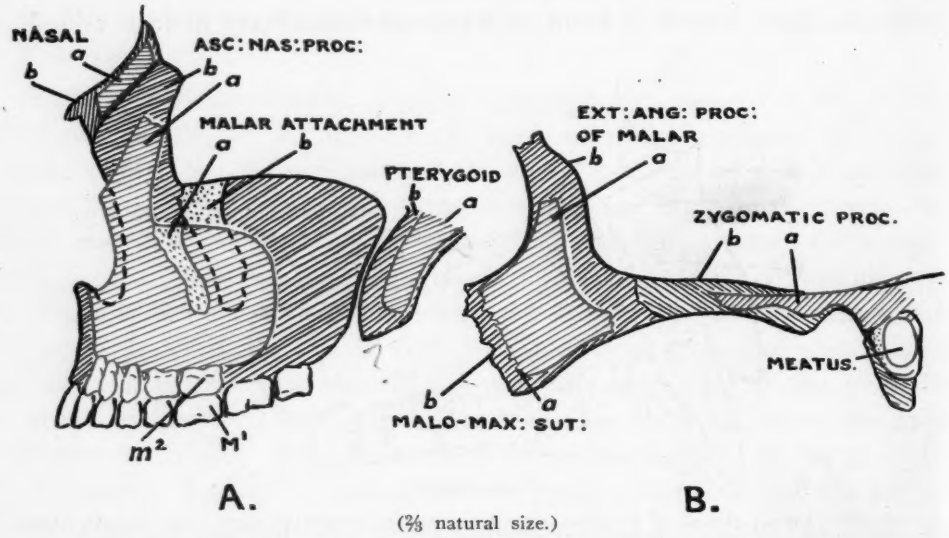

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Fig. 7.—A: Lateral aspect of maxilla and nasal bone of a child of five (a) superimposed on the corresponding parts of adult male skull (b). The area to which the malar applied is indicated by stippling. The pterygoid processes are also superimposed. B: Temporal and malar elements of the zygomatic arches of the same individuals superimposed to show the extent of growth at the temporo-malar and malo-maxillary sutures.

This process, between the 5th and 25th years has 11 mm. added to its vertical height (Fig. 7*B*). The addition made at the lower or masseteric border of this bone is relatively slight—3 or 4 mm. only, except in cases of contracted palate when the masseteric border occupies an abnormally low position. The increase in height at the alveolar border has been mentioned already.

In Fig. 8 a demonstration is given to show that the changes which occur in the maxillæ of acromegalics are of the same nature as those which occur in the faces of growing children. At the same time we cannot fail to note the influence of the pituitary body on facial growth; with a disordered enlargement of the pituitary we see all the growth changes of youth reawakened in the adult. In Fig. 8*A* the maxilla of a child of 5 years is superim-

posed on the maxilla of an English adult male with well-developed face. The specimens are not those shown in Fig. 7*A*, but the changes due to growth are of the same nature although differing in detail. In Fig. 8*B*, the normal adult maxilla shown on Fig. 8*A* is superimposed on the maxilla of a man who had been the subject of acromegaly for over 15 years. The growth changes seen in Figs. 8*A* and *B* are clearly of the same nature and almost the same degree.

THE SUPRA-ORBITAL REGION OF THE FRONTAL AND ITS RELATIONSHIP TO THE FUNCTION OF MASTICATION

In everyday speech we count the forehead an essential part of the face but anthropologists have found it convenient to exclude it from the "anatomical" area to which they give this name. That the supra-orbital region

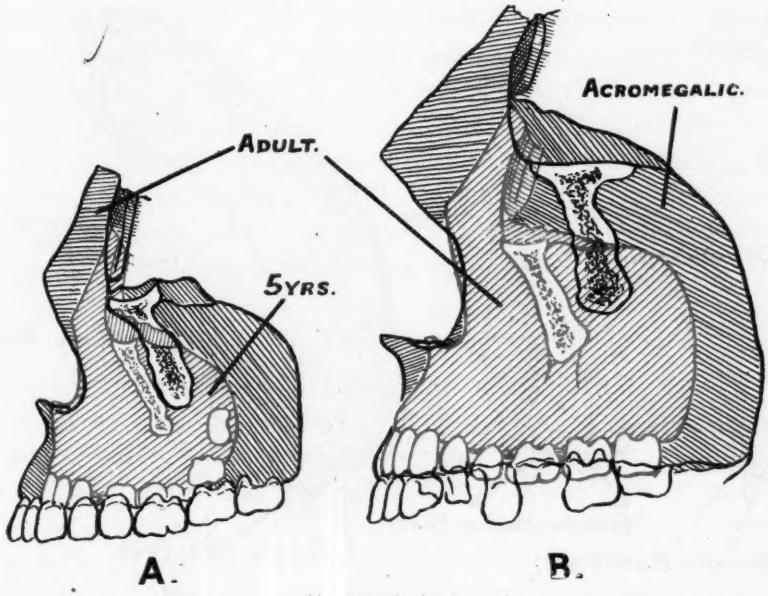

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Fig. 8.—A: Left lateral aspect of maxilla of child of five years superimposed on maxilla of adult Englishman. The specimens represented are not those shown in Fig. 7 although they illustrate corresponding age changes. B: The adult bone shown in Fig. 8A, superimposed on the maxilla of a man who was the subject of a chronic form of acromegaly. These specimens show the same kind and degree of difference as are depicted in Fig. 8A.

of the frontal is, like the cheeks and jaws, an essential part of the apparatus of mastication there can be no manner of doubt. These stout bony struts, the ascending nasal processes, go up between the orbits to rest the maxillæ on the mesial part and supra-ciliary regions, of the supra-orbital bony bar, the glabellar; on the outer or lateral wall of the orbit, the frontal processes of the malars prop the maxillæ on the external angular extremities of the supra-orbital bar.

In Fig. 9*A* is shown the frontal bone of a child, aged 5 years, seen on its anterior aspect and superimposed on an English adult with well-developed jaws, the superimposition being guided by internal or cerebral markings. It will be observed that the internal angular or fronto-nasal process of the

frontal has new bone deposited on it to the thickness of 3-4 mm. from the 5th to the 25th years. The inter-orbital prop is increased in width or thickness by 6 or 8 mm. of new bone. New bone is also laid down on the supra-orbital margin. The changes at the outer end of the supra-orbital bar (Fig. 9*A*) are much more extensive and important. The external angular or malar process of the frontal is moved outwards by a process of growth during the 5th-25th year period to an extent of 15 mm., becoming stronger and more massive as it reaches its adult position. The process involved is the usual one—absorption on the mesial aspect of the process, deposition on its outer or lateral aspect. Thus the width of the supra-orbital bar, measuring about 78 mm. in the 5th year, becomes 30 mm. wider before the adult stage is reached in a modern robust-faced Englishman. These growth changes are correlated with others which take place in maxillæ and malars.

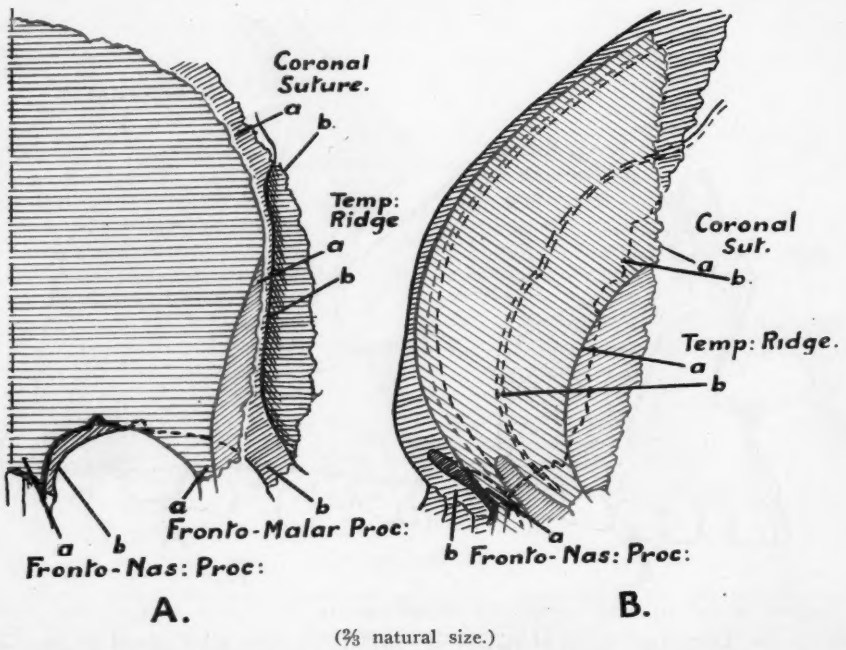

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Fig. 9.—A: The anterior aspect of the left half of the frontal bone of a child of five (a) superimposed on the left frontal of an Englishman with normally developed jaws (b). The bones are superimposed so that points on their inner or cerebral aspect coincide. B: The same bones seen in profile and superimposed according to internal markings.

Still more remarkable changes are to be observed in the frontal when mature and immature stages are viewed in profile (Fig. 9*B*). Here the bones have been superimposed so that points on their internal or cerebral surfaces coincide. The forward movement of the nasion and naso-glabellar region is again shown; the importance of this growth movement in adding to the *E* line has already been mentioned; in this case the movement in the 5th-25th year period is represented as 12 mm. We might have reproduced here superimpositions of the frontal bone of an acromegalic and normal man to show that the growth changes in the fully-formed frontal are of the same nature and degree as those represented in Fig. 9*B* in the youthful growing frontal bone. The profile tracings show that there is a forward movement of the malar

process of the frontal during the later years of growth. This is correlated with the forward extension of the temporal muscle on the frontal bone throughout the 5th-25th year period. In Fig. 9*B*, the temporal line or ridge in the adult frontal lies 14 mm. in advance of the position occupied in the child. But besides these local changes in the supra-orbital bar and temporal ridges there is a rotatory movement of the frontal as a whole during the later years of growth. This rotatory movement, which varies much in its extent, is brought about by growth changes along the coronal suture. In the 5th-25th year period new bone is rapidly added to the upper part of the frontal bone—at the margin entering into the upper part of the coronal suture (Fig. 9*B*), while in the lower, the part of the suture covered by the temporal muscle, the opposite is happening: bone is being removed from the frontal edge, while the parietal edge extends forward. In this manner the lower or temporal segment of the coronal suture is advanced towards the forehead in the later years of adolescence. All of these frontal transformations are part of the mechanism of face and jaw growth. We have already drawn attention to the great coronal system of growth sutures—the "coronal complex." If growth of the upper face is abnormal the fault is to be sought for in some part of this complex—in the ptery-go-maxillary part, tempo-ro-malar, spheno-ethmoid, palato-maxillary, spheno-frontal, or in some part of the coronal suture proper. Normal growth implies that the process of bone growth all along this complex is proceeding in an orderly manner.

GROWTH IN THE MANDIBULAR REGION

We have now finished with the mechanism of growth in the upper face—at least so far as concerns its extension in a forward and vertical direction. Before proceeding to discuss growth in the mandibular region of the face we should like to express our conviction that the growth of the upper face is not only of much greater complexity than is mandibular growth but that the upper facial growth is the "pace-maker," as it were, to which the lower or mandibular mechanism has to adapt itself. There must be a mechanism for harmonizing growth at all sites where new facial bone is laid down but we suppose that an essential part of this mechanism must be one which adapts mandibular to maxillary growth. It is not necessary to point out that whatever the nature of this growth coordinating mechanism may finally prove to be, it is one very liable to be upset under modern conditions of life. Here, too, we may state our belief that in the lower jaw, just as in the upper, we have to distinguish the alveolar bone as constituting a separate growth element, differing in its reactions and nature from the supporting framework of bone on which the alveolar element is set. From remote times anatomists have known that this alveolar element is absorbed and completely disappears with the removal of the teeth. Its life and reaction depend on the presence of the teeth. Sir Frank Colyer has shown that in lower vertebrates the alveolar element in the mandible may be demarcated from the supporting element by sutural lines. In the adaptation of lower to upper teeth it is the alveolar bone element which reacts and brings about apposition. Alveolar

spongy bone is peculiarly sensitive to the pressures and stresses brought to bear on it in the course of mastication.

Line *G* (Fig. 1) represents the distance of the mental eminence from the mid-point of the trans-meatal axis. In Fig. 10 are given the growth elements crossed by this line. The mesial aspect of the mandible of a child of 5 years has been superimposed on corresponding points of an adult mandible—the difference between the two representing the growth changes which are effected during the 5th-25th year period. The position of the mid-meatal axis is shown in each specimen. In the child, the "*G*" line measures 84 mm., in the adult, 132 mm.; the line, as indicated by these isolated samples, has been extended 48 mm. in 20 years. Of the 48 mm. thus added, 40 of them have been obtained by condylar growth—by the deposition of bone under the cartilage covering the upper and posterior aspects of the condyle. The remainder—some 8 mm. has been obtained by bone deposed on the lower and anterior aspect of the chin, thus deepening the mandibular symphysis and

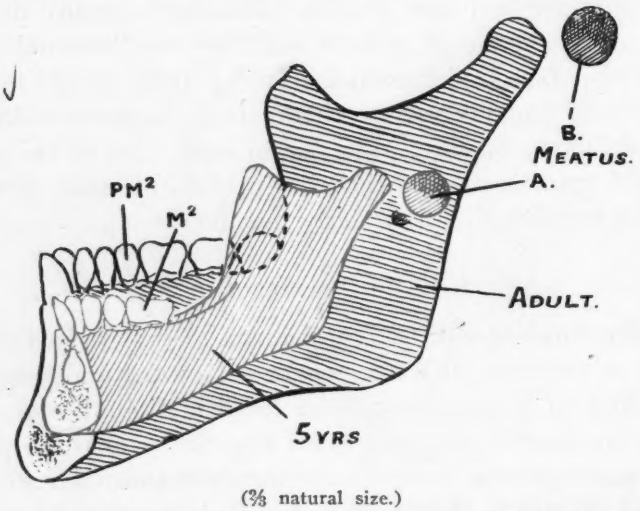

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Fig. 10.—Mesial aspect of mandible of a child five years (A) superimposed on corresponding points of adult male (same specimens as are represented in Figs. 2, 3, etc.).

extending it forwards. These calculations are based on the belief—by no means well supported, that there is no forward migratory movement of the mandibular alveolar element—the element which carries the mandibular teeth—but that the buds of the premolar teeth rise up and occupy the same relative position in the mandible as the milk molars did in the young child. The superimposition on Fig. 10 is based on the truth of this belief.

In Table I the mean distance of the mental or lower chin point from the mid-meatal point is given as 119.9 mm.; at the 10th year, 98.6 mm.; the chin is thus advanced 21.3 mm. in a forward and downward direction during the course of about 10 years. It is a notable fact that the advance is much more rapid after the 16th year than before it. While the advance is but 5.7 mm. between the 10th and 16th years, it is 15.6 mm. between the 16th and 21st. Table I also shows that the distance is much less stable—shows greater degree of fluctuation after than before the 16th year. It will be remembered

that the same high variability characterized the later stages of maxillary growth.

In Fig. 11 other figures are given to illustrate the mechanism of mandibular growth. In Fig. 11*A* the mandible of a 5-year child is superimposed on that of a robust-faced Englishman, while in Fig. 11*B*, the same adult mandible is placed on the corresponding parts of the subject of acromegaly. In both figures the growth changes are seen to be of the same nature—of the same relative extent. These figures bring out the different behavior or reactions of the alveolar and of the supporting bone. In the acromegalic both elements react by growing, particularly the chin or supporting element which receives a pronounced enlargement. The special growth and prominence of the chin and supporting mandibular element in acromegalics are to be explained by the enlargement of the tongue and mouth musculature. The supporting framework of the mandible serves the uses of these muscles as well as the needs of the teeth. In the majority of acromegalics only the mandible

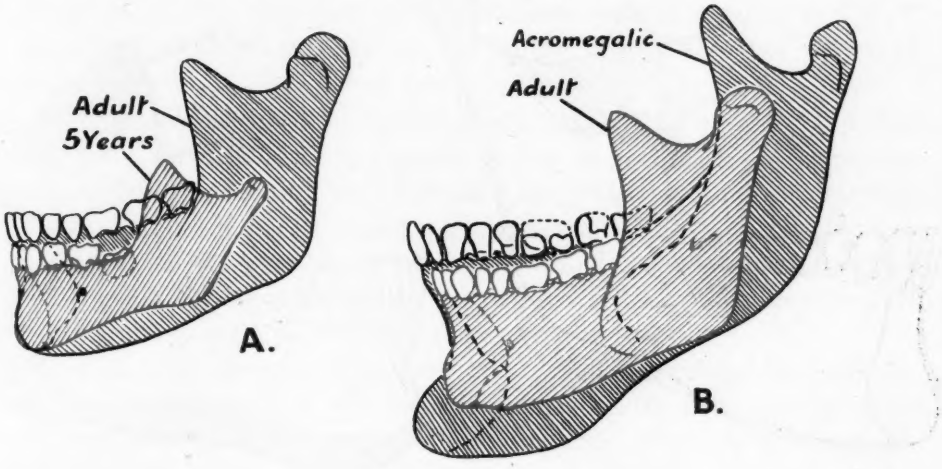

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Fig. 11.—A: Mandible of child aged five years, superimposed on mandible of adult male Englishman. These are not the specimens represented in Fig. 10. B: the adult jaw represented above, superimposed on the mandible of man who was the subject of acromegaly for over fifteen years.

responds to growth; the alveolar element of the maxillæ may not be affected; this we regard as due to the ease with which growth is set up under the condylar cartilage of the mandible.

The value of the length of the line "*G*," from a functional point of view, depends on the length of the face—the distance of the chin from the nasion. This is brought out by the two mandibles, both of Englishmen, superimposed in Fig. 12*A*. In the specimen labelled *b*, the distance of the chin point from the mid-meatal is 130 mm.; in *a*, the better-formed mandible, it is only 115 mm. The specimen "b" is from a man who had a narrow but deep palate, with long contracted face, the chin being 130 mm. distant from the nasion, whereas specimen "a" is from a man with a well-formed palate and facial length of 115 mm. In "b" it is seen that the angular or masseteric region of the mandible is ill-developed; the deep development of the alveolar

element of the upper jaw has led to the body of the mandible being pressed downwards, so that the body of the mandible is laid down at an open angle to the ascending ramus, the mandible has the appearance of having been laid down with the mouth kept in a gaping position. Here we have an increase in the *G* line due to an abnormality in the growth of the upper face. In Fig. 12*B*, the growth of a woman's and man's mandible are contrasted. The male outstrips the female in all three elements—the alveolar, supporting and muscular or ramal. As in acromegaly we see herein the influence of the hormone system on growth control.

We have said very little concerning the growth of the mandible; this is the only bone of the face in which the mechanism of growth has been studied in detail hitherto. Figures 10 and 11 illustrate where new bone is laid down and where old bone is removed. We would just add a word or two here as

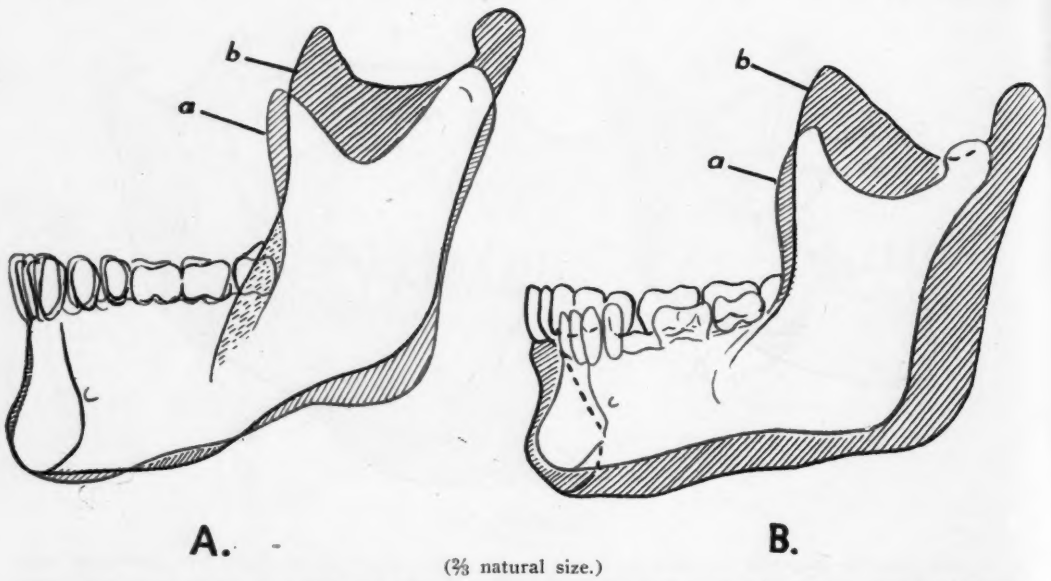

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Fig. 12.—A: The mandible of a man with narrow, deeply arched palate (b) superimposed on a specimen from a man with normal palate (a). B: the mandible of a woman (a) superimposed on that of a man (b) to show the difference in development of all three elements of the mandible—alveolar, supporting, and muscular or ramal. Their difference depends on the growth influence of the sexual glands.

to the part taken by mandibular growth in adding to the length or vertical height of the face. In the symphysial region, as is illustrated in Fig. 10, 17 mm. is added to the vertical height of the face during the 5th-25th year period. In the samples chosen in Fig. 10, line *D* (see Fig. 1, Table I) measures 25 mm. at the 5th year and 42 mm. in the adult. Table I shows that the "*D*" line has a mean height of 35.8 mm. in the 10th year, 40.8 mm. in the 16th and 44.4 mm in the adult, the increase being 5 mm. in the 10th-16th year period and only 3.9 mm. in the 16th-21st year period. In the general development of the face the increase in height of the ascending ramus is of importance. From the sample shown in Fig. 10 one infers that the ascending ramus adds 28 mm. of new bone to its height in the 5th-25th year period.

THE GROWTH-MECHANISM CONCERNED IN GIVING WIDTH TO THE FACE

So far we have been studying the sites at which new bone is laid down to give an extension of the face in forward and in downward directions; we now proceed to examine how the face expands in width—the most important direction to secure a normal development of the parts concerned in mastication. From observations made by one of us (A. K.) on prehistoric English skulls we are convinced that in a considerable proportion of the modern population of Britain there is a tendency for the face to become longer and narrower. This tendency is directly related to narrowing and arching of the palate. Bony matter is apparently laid down to about the same amount in these long contracted, hatchet faces as in the shorter, wider, more primitive prehistoric faces, but from some alteration in the mechanism of growth new bone which was formerly laid down to add to the width of the face is, in a large proportion of present-day people, deposited so as to increase the length at the expense of the width. With this reduction in width comes a pinching of the facial skeleton from side to side leading to the irregular projection of points situated in the middle line of the face—between the nasion above and the chin below (see Fig. 1).

The mechanism concerned in the increase in width of the supra-orbital part of the face—about 30 mm. in amount during the 5th-25th year period—has been illustrated in Fig. 9*A* and discussed in the text accompanying that figure. We shall proceed here to discuss the mechanism involved in widening the infra-orbital region of the face, the region which is made up of maxillæ, malars and nasals, and which enclose the nasal cavities. The hard palate is the central and essential part of this region of the face.

In Fig. 13*A* is represented from the front the infra-orbital part of the face of an Englishman with a well-formed palate—width between the outer margins of crowns of 2nd molars = 62 mm.—and the distance of the zygomatic arch from the mesial sagittal plane of the skull being 66 mm.—the bi-zygomatic width 132 mm. In the skull of the child, aged 5 years, the width between the outer margin of the second milk molars is 42 mm. while the zygomatic arch stands 49 mm. from the sagittal mesial plane—the bi-zygomatic width being 98 mm. In the samples chosen the bi-zygomatic width of the face increases from 98 mm. to 132 mm.—an addition of 34 mm. during the 5th-25th year period. Where is this new bone laid down? A glance at Fig. 13*A* will show that we believe the greater part is laid down on each side of the malo-maxillary suture; the addition made at this suture represents an increase of 10-11 mm. of new bone on each side, giving 20-22 mm. of the 34 mm. of total increase. There is new bone laid down on the lateral aspect of the malar and zygomatic arch, giving an addition of 3 or 4 mm. on each side. It is to the third site we would particularly direct attention—the intermaxillary and internasal sutures. So far we have met no mention by previous investigators that they regarded the mesial suture of the palate, passing from nasal spine in front to the palatal spine behind, as an important growth suture. It is when we come to explain the widening of the nasal floor during the years of growth and the corresponding widening of the palate, and to ac-

count for the growth movements which can be demonstrated, that we become convinced that new bone is laid down in the intermaxillary suture. As depicted in Fig. 13A we believe that the normal increase at this suture during the 5th-25th year period is about 8 mm. in width—4 mm. on each side. We shall come back to the point in discussing growth of the palate.

In Fig. 13*B* is represented the infra-orbital face of an Englishman with narrow, deeply-arched palate (the distance between the outer or buccal surfaces of the second molar crowns was 48 mm., between their inner surfaces 27 mm.), with long hatchet-face and fallen-in cheek bones. On his face have been superimposed the bones of a child 5 years of age, the same as are represented in Fig. 13*A*. There has been apparently no growth in the intermaxillary suture or on the lateral aspect of the zygoma after early childhood. There has been growth at the malo-maxillary suture but of an irregular nature, particularly on the malar side of this line. The malar instead

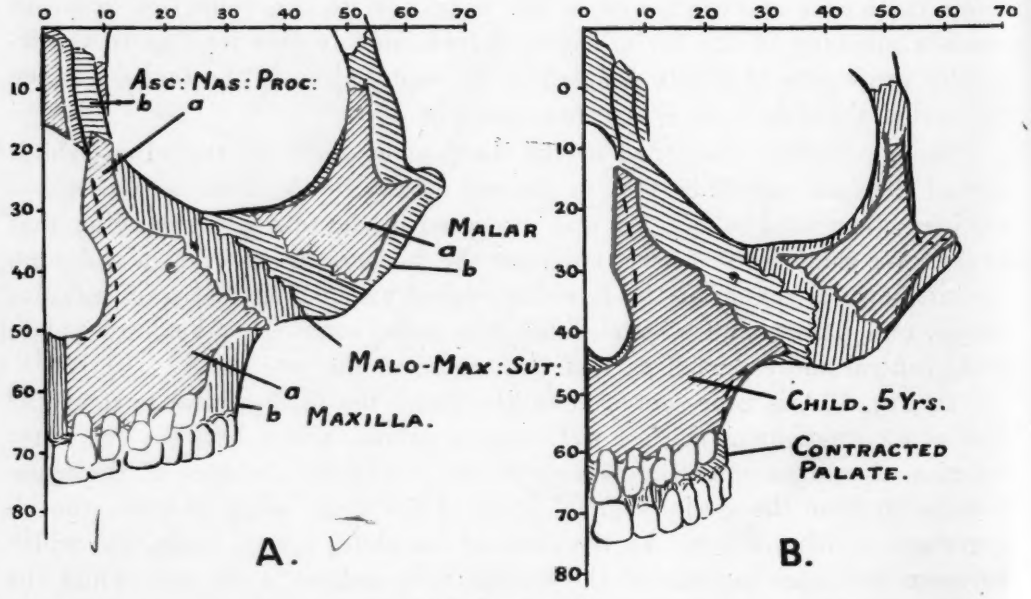

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Fig. 13.—A: The left maxilla malar and nasal bones of an Englishman with wide palate and robust, symmetrically developed face, represented on their anterior aspects. On these adult bones have been placed those of a child of five years, superimposed so as to bring out the areas of bone growth during the fifth to twenty-fifth year period. B: The same bones of an Englishman with narrow, deeply-arched palate, long hatchet face. On them have been superimposed the same child's bones as are represented in Fig. 13A.

of expanding in a lateral direction has tended to spread in the direction of the pull exercised on it by the masseteric muscle. The alveolar element in place of expanding laterally has spread downwards, in a vertical direction. The ascending nasal process of the maxilla and the frontal process of the malar are particularly long, giving the modern orbit its great depth. We have here a marked disturbance in the normal process by which the face expands in a lateral direction.

In Fig. 14 the process of norml growth of the face is contrasted with that seen in acromegaly. In Fig. 14*A* is represented the growth changes during the 5th-25th year period, but in this case the child's maxilla has been

superimposed as if no growth took place at the intermaxillary suture. In Fig. 14*B* the bones of the adult shown in Fig. 14*A* have been superimposed on the infra-orbital face of a man who was the subject of acromegaly for 15 years. The mechanism of growth which is seen at work is the same as that seen in youth, only of an irregular kind. The irregularities seen in Fig. 14*B*, so far as their nature is concerned, are not unlike those which affect the contracted face, represented in Fig. 13*B*.

STUDY OF FACIAL GROWTH AS SEEN ON THE BASE OF THE SKULL AND PALATAL ASPECT OF THE FACE

In the study of the growth of the face the approach which gives the most instructive results is by a route not possible in the living—only in dried

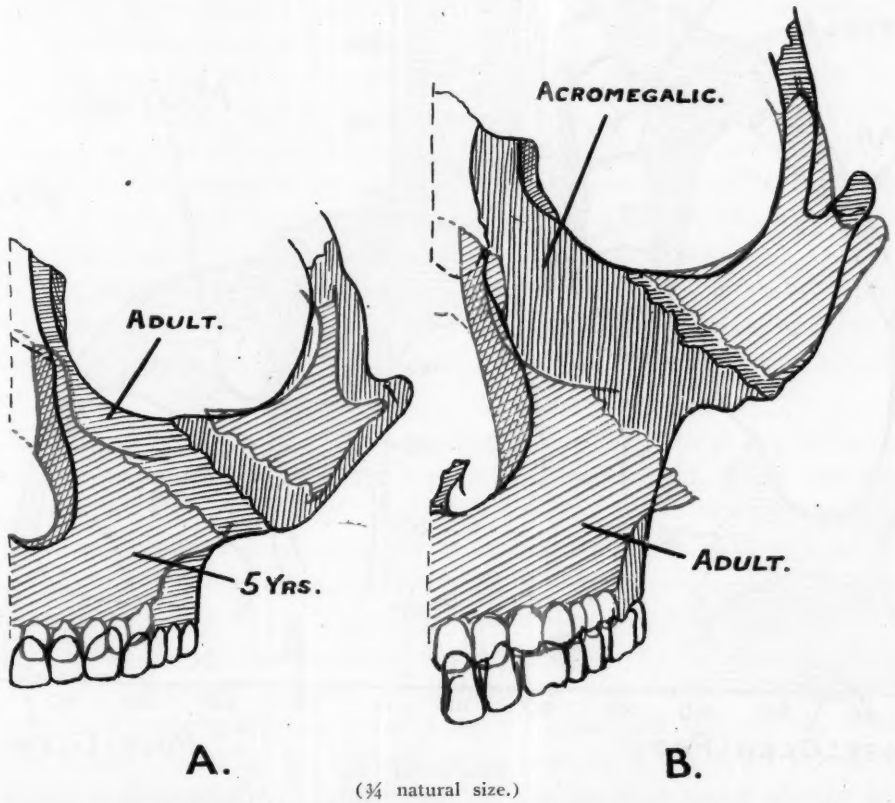

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Fig. 14.—A: The infra-orbital part of the face of an Englishman (A), with bones of a child of five years superimposed to compare with the infra-orbital part of the face of a subject of acromegaly. B: on which the bones of a normal adult have been superimposed.

macerated skulls. The approach is that depicted in Fig. 15 where the basal aspect of the palate is drawn—the drawing being made on a place represented by the premolar and molar parts of the alveolar margin of the palate. The zygomatic arches are also included; so are the maxillæ. The post-glenoid spine, which marks the posterior limit of the masticatory area on the base of the skull, is taken as a base line, from which the forward movement of parts is estimated during the growth of the face (line shown in Fig. 15). In Fig. 15*A* the state of matters is that reached at the completion of the milk

dentition and during the formation of the first permanent molar in the 4th year of life. The problem we have to solve is: how does a palate such as that represented in Fig. 15*A*, become the adult palate depicted in Fig. 15*B*? The drawing shows that in the 4th year the incisor alveolar margin lies 60 mm. in advance of the post-glenoid base line; in the adult it is 100 mm. in advance. In the 4th-25th year period this part of the palate is advanced 40 mm. What is the mechanism involved? In the child's face (Fig. 15*A*) the zygomatic arch is 47 mm. from the mid-line; in the adult it is 68 mm., an increase of 21

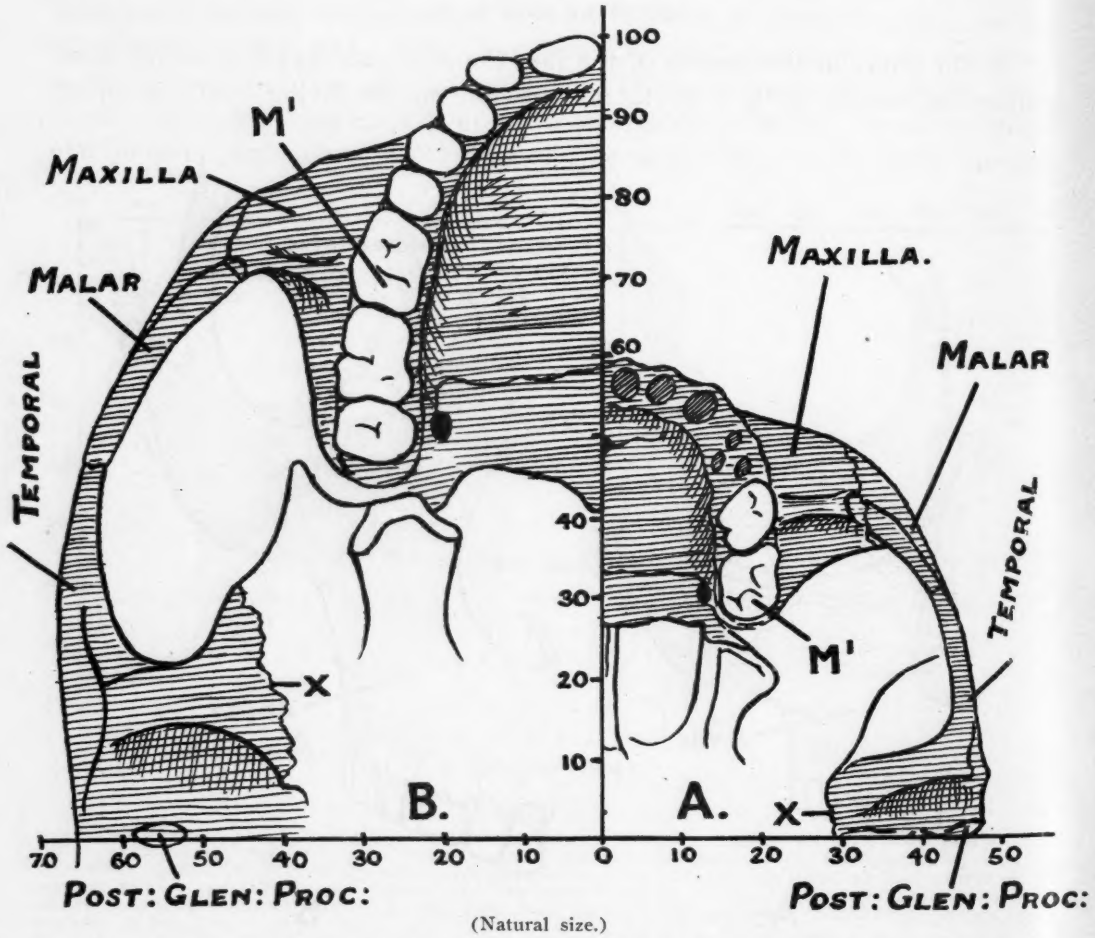

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Fig. 15.—A: The left half of the palate and zygomatic arch of a child in which the milk dentition is completed and the crown of 1st permanent molar is forming; about four years of age; drawn on the plane of the alveolar margin. The base line crosses the postglenoid spine. B: the right half of the palate and supporting zygomatic arch of an adult Englishman, with well-developed palate and jaws. The base line CC passes through the post-glenoid spine. In the adult, the post-glenoid spine forms the anterior boundary of the meatal passage; it lies 4 mm. in advance of the mid-meatal point.

mm. How is this extension obtained? Further, a very important point, the outer edge of the great wing of the sphenoid, the spheno-temporal suture (*X*, Fig. 15) just mesial or internal to the temporo-maxillary joint is 27 mm. distant from the mid-line in the child but it is 38 mm. distant in the adult. The growth of the face is attended by a pushing outwards of the region of the temporo-maxillary joint—the movement depending on the growth of the great wing and body of the sphenoid.

In Fig. 16 a, b, c, an analysis is given of the sites at which new bone is laid down from the 4th to the 25th year. In Fig. 16 the maxilla and the palate represented in Fig. 15*A* (a younger stage than has been used in previous illustrations) have been superimposed on the adult maxilla and palate represented in Fig. 15*B*. As near as possible the alveoli of the milk teeth have been placed over the corresponding alveoli of the adult palate. To obtain this superimposition it will be seen that it has been necessary to assume a growth at the intermaxillary suture; as previously stated we believe that about 4 mm. of new bone is added at each side of this suture during the eruption of the permanent dentition. Besides there is, or should be, also a lateral and forward growth of the alveolar element of the maxilla; 21 mm. of new bone has been added to the alveolar arch to carry the sockets of the 2nd and 3rd permanent molars. The maxillary palate has been extended backwards at the transverse palatal suture, 11 mm. of new bone being thus added. It will also be seen from Fig. 16*A* that the malar or cheek part of the body of the maxilla has been extended laterally 10 mm. by growth at the malo-maxillary suture, and at the same time has been moved backwards by remodelling, so that the malar process, instead of lying in line with the 2nd milk molar, comes opposite to the first permanent molar. The forward extension of the palate is largely the result of interpolation of new bone on the maxillo-palatal part of the great coronal sutural complex.

In Fig. 16*B*, the growth of the horizontal plate of the palate is depicted; if the posterior palatine canal may be regarded as fixed during growth then addition is made to both anterior and posterior borders of the horizontal palatal plate.

During the eruption of the permanent molar teeth the temporo-mandibular area of the base of the skull is revolutionized—particularly during the later stages of dental eruption. Not only are the articular surfaces altered in shape and extended in size, as shown in Fig. 16*C*, but new bone is added at both margins of the temporal bone; on its mesial side, about 6 mm. of new bone is added in the spheno-temporal suture (see Fig. 16*C*) and a like amount at its lateral border. All the time, too, the temporo-mandibular region is being pushed laterally by increase in the width of the sphenoid bone—by new bone being laid down on the sphenoid side of the spheno-temporal suture (see Fig. 15). There is no need to again draw attention to the extensive interpolation of new bone in the temporo-malar suture of the zygomatic arch, nor to the growth of the malar itself. Thus it is seen that the 40 mm. which the incisor part of the maxilla moves forwards from the 4th to the 25th years, depends on new bone being laid down in the temporo-mandibular region of the temporal bone; to new bone interpolated in the zygomatic arch, to new bone interpolated at the posterior end of the alveolar arch and transverse suture of the palate and to new bone deposited on the anterior or labial aspect of the alveolar margin of the maxilla.

Fig. 17. That the narrow deeply-arched palate is not a single defect in an otherwise well-developed face, but part of the failure in the general growth of the face, will be seen from the comparison made in Fig. 17. Here

we have placed an exact drawing of the right half of the temporo-palatal region of a prehistoric Englishman, one with well-spread palate and a full and robust development of jaws, as was the rule in the prehistoric Britons. On this well-developed ancient face we have placed the corresponding parts —drawn like the first on the alveolar plane—of a modern Englishman with long narrow face, contracted palate, and imperfectly grown jaws—a representative of the "adenoid faces." The molar teeth of the modern skull will be seen to fall 5 mm. inside the corresponding teeth of the ancient skull; it is so also with the canine and incisor teeth. We regard the

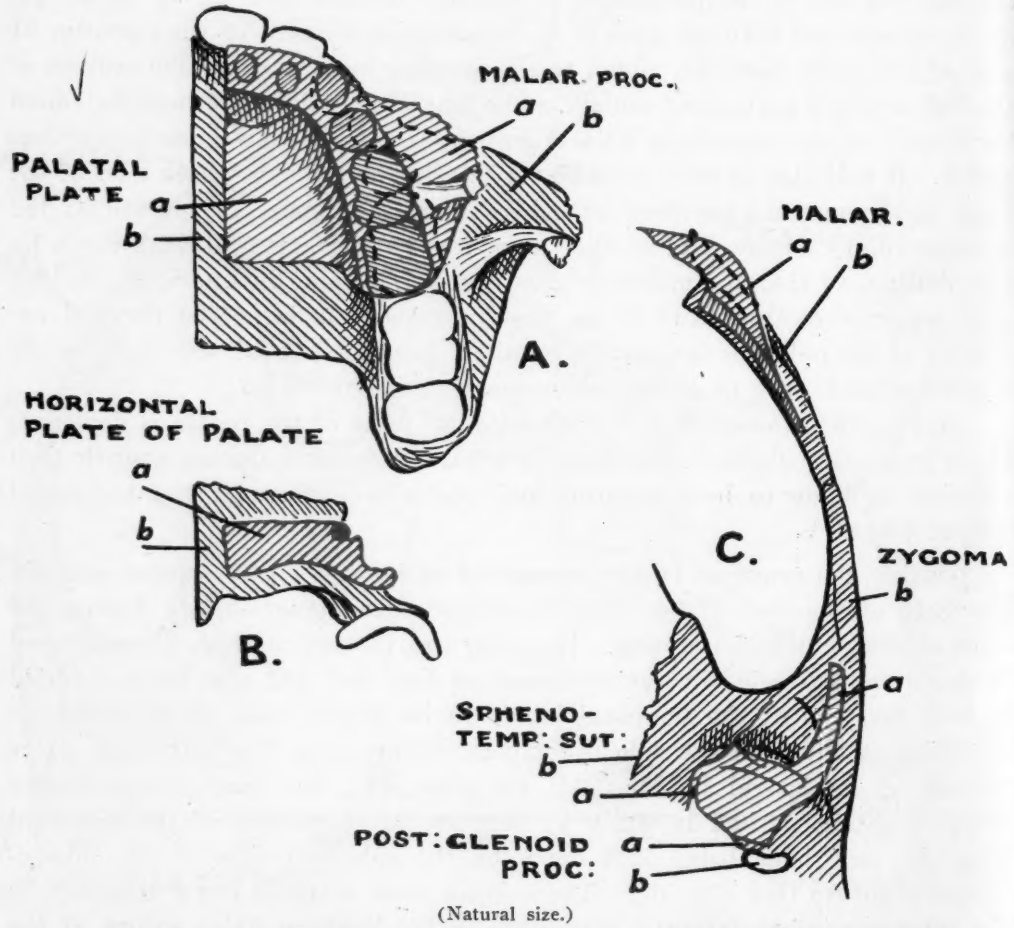

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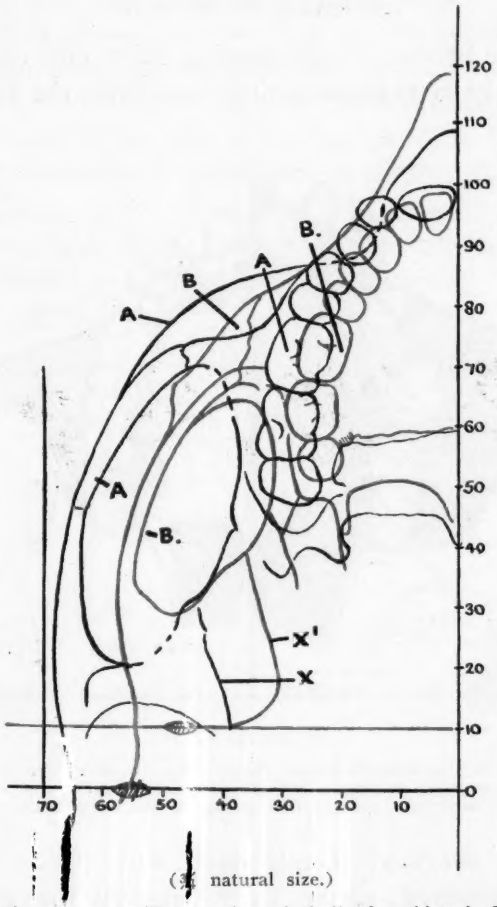
Fig. 16.—The palates shown in Fig. 15 taken apart, and the individual parts superimposed. (A) The palate, alveolar margin and maxilla of "a," a child aged four years, superimposed on the same parts of the adult "b." (B) The palate bone of the child superimposed on the palate bone of the adult, the orientation being guided by the position of the posterior palatine canal. (C) The temporo-mandibular region with the parts of the zygomatic arch superimposed on the corresponding parts of the adult.

defective or diminished spread of the palate in the modern skull as being due, in the main, to a failure of bone growth along the midline suture of the palate—the intermaxillary suture. The lower end of the malo-maxillary suture, marking the anterior limit of the origin of the masseteric muscle, lies 10 mm. further outwards and forwards in the ancient than in the modern skull. The lateral spread of the ancient zygomatic arch is 11 mm. greater than in the modern. In the region of the temporo-mandibular joint we see

even greater differences between the growth of the modern and ancient skulls. Mention has already been made of the growth of this region and its migration outwards or in a lateral direction owing to the expansion of the great wing of the sphenoid in the later stages of molar eruption. It will be observed that the outer edge of the great wing of the sphenoid on the modern skull (Fig. 17 x) lies 8 mm. internal to and in advance of the corresponding point (x) of the ancient skull. Further it will be observed that the post-glenoid spine in the modern skull lies 8 mm. in advance of and 8 mm. mesial or internal to the post-glenoid spine of the ancient skull. This indicates



(⅓ natural size.)

Fig. 17.—Left half of temporo-maxillary region of skull of prehistoric Englishman (A) with primitive, well-developed palate and jaws, drawn on the plane of the alveolar margin. On this primitive palate is placed that of a modern adult Englishman (B) in which the face was narrow and elongated, the palate contracted and the jaws imperfectly grown.

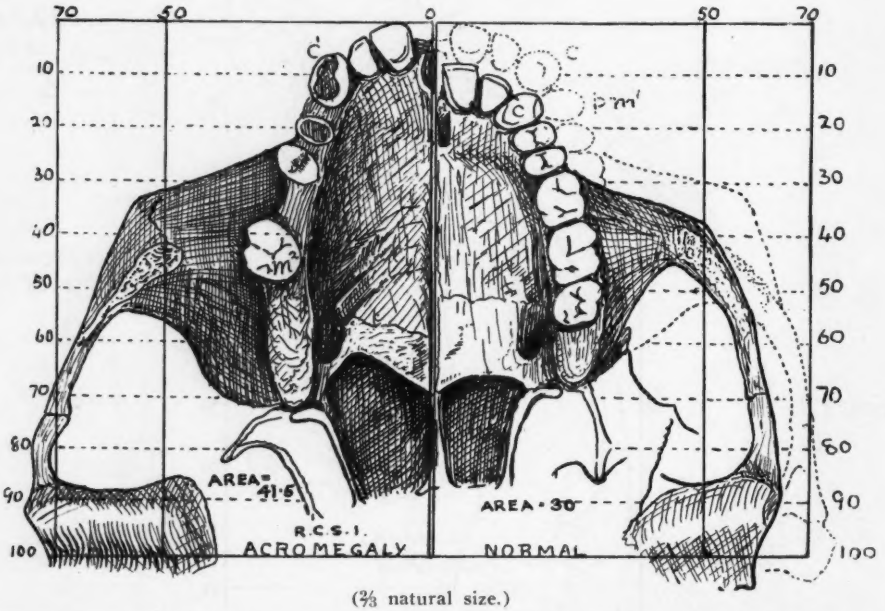
that the forward movement of the whole palatal bony scaffolding of the modern skull has been arrested and that the naso-pharyngeal space has been restricted by a failure in the mechanism of facial growth.

Further evidence as to the nature of the defective growth of the face so common among modern Englishmen and particularly Englishwoman will be gleaned from an examination of the careful drawings reproduced in Fig. 18. On one side of that drawing is depicted the zygomatic arch, maxilla and palate of an Englishman who was the subject of acromegaly for many years

—one of these cases where overgrowth affected the maxillæ as well as the mandible. Side by side with this drawing is set the corresponding parts of a well-developed skull of a modern Englishman. The difference between the acromegalic specimen and the normal one is of the kind shown in Fig. 17 in which the ancient, well-developed and modern contracted palates are compared. The differences are those which result from an arrest or a disorder of the mechanism of growth. With the disordered enlargement of the pituitary we have a disorderly growth of all the parts concerned in mastication.

SUMMARY OF RESULTS

In this paper we believe we are opening out a new chapter in our knowledge pertaining to the mechanism which transforms the face of the child into



(⅔ natural size.)

Fig. 18.—Right half of the temporo-palatal region of a subject of acromegaly, compared with the corresponding region of a normally developed skull of a modern Englishman. Round the drawing of the normal palate are shown in stippled lines the dimensions of the acromegalic palate and zygomatic arch.

that of the adult. We have merely dealt with the general nature of the growth-machinery involved; we are fully conscious that a long and laborious investigation is needed to elicit the exact details relating to the changes which occur at each year of a child's life; further observations on both living and dead are needed. But we have shown enough to convince everyone that the so-called "adenoid face," the narrow, deep palatal arch, the irregular eruption of teeth, are not due to a simple mechanical cause such as the presence of enlarged tonsils, or of adenoid vegetations in the respiratory tidal way. We are dealing with an arrest or a disturbance of the elaborate machinery which underlies facial growth. We have produced evidence showing that this mechanism is influenced by the functional state of the pituitary and of the sexual organs. We regard enlargement of the tonsils, the growth of adenoid vegetations in the naso-pharynx, and disordered or irregular growth of the

jaws and face as manifestations of a single pathological state. What the exact nature of this underlying pathological condition may be we are not yet in a position to decide, but when we keep in mind the close relationship there is between bone-formation and bone-growth, and the action of the glands of internal secretion on the one hand and the frequency with which a hypertrophy of the lymphoid system is accompanied by a defective formation of bone on the other, it is not difficult to believe that irregularities of the jaw and the development of adenoids may result from a nutritional disturbance. The explanation may come through the kind of research now being conducted by Colonel McCarrison, who has shown that a diet deficient in certain vitamine constituents will affect the normal working of the hormone growth systems of the body. Vitamines appear to act directly on the glands of internal secretion. We suspect that the defects which are so frequent in the growth of the English, or rather Nordic, face may ultimately prove to be the result of some deficiency or error in the dietary on which our infants and youths are reared. No doubt, too, our modern dietary is of a kind which leaves teeth, jaw and muscles of mastication imperfectly exercised. The physical stimuli which are necessary for the normal growth of bone are missing. This, too, may be a factor in gnathic degeneration.

THE IMMEDIATE TORSION OF INCISOR TEETH*

F. Bocquet Bull, L.R.C.P., M.R.C.S., L.D.S.

I AM reading this paper to you this evening with the hope that perhaps the results of eight cases of irregular teeth treated by immediate torsion in the Dental Department of Guy's Hospital may be of interest to you.

The practice of immediate torsion dates back as far as I can find for many years. Tomes in his "Dental Surgery" mentions a case reported in the "Transactions of the New York Odontological Society for the year 1875" of a right supernumerary tooth twisted by immediate torsion. The details of the operation of immediate torsion are given by him in his "Dental Surgery," as well as by Colyer in his "Injuries and Diseases of the Teeth." Bennett's "Science and Art of Dental Surgery" also gives valuable information on the subject.

In this country the operation of immediate torsion has been practiced by Dolamore and Spokes. Apart from these surgeons, I have not been able to trace others who have adopted it on any extensive scale, and apparently it is but little practiced, if at all, at the present time.

A rotated tooth may be moved by one of two methods, viz., by slow torsion or immediate torsion. There may be many of you here tonight who would say, "Why take the risks of the operation of immediate torsion, viz., killing the pulp, fracturing the tooth, causing necrosis of the bone around the tooth with subsequent loss of the tooth, when you can obtain the requisite result by slow torsion without any risk whatsoever?" To those of you I would say that, if your cases are selected carefully, the risks alluded to are largely illusory, and, on the other hand, the time and labor saved both to you and your patient are very considerable.

The tissues involved are numerous, consisting as they do of the pulp, dentine, cementum, periodontal membrane, bone, and to a minor extent, the overlying gum. Of these, the part most likely to be damaged, as one would expect, is the all-important one, the pulp.

Modus Operandi.—It having been decided that the tooth under consideration should be rotated by immediate torsion, and here let me state that, as in all other operations, the slight risk in connection with it should be pointed out to the parent or guardian, two sets of models should be made, one for the purpose of record, and the other for the purpose of splint-making.

The making of the splint needs careful consideration, as upon this greatly depends the success or otherwise of the operation. Personally I like to make an anchorage of two teeth if possible, although one tooth will suffice. The anchor teeth need not necessarily be upon both sides of the tooth to be rotated. The first step is to carefully remove the tooth to be rotated from the model

*Read before the British Society for the Study of Orthodontics, November 7, 1921.

by cutting around it at the cervical margin and then gently levering it off. Having done this it is replaced in the desired position on the model by means of hard wax.

A very thin wax matrix is made covering about two-thirds of the crowns of the teeth to be splinted. Great care should be taken not to run the splint up between the sides of the teeth, or otherwise the splint will be difficult, or almost impossible, to adjust. Further, the matrix should be cleared or thinned enough on the palatal surface to prevent interference with the articulation.

The matrix is then invested in the usual way and cast in Ash's silver-copper alloy. This runs very easily, need not be gilded, and has no deleterious effect on oral tissues.

All the cases that I have records of to show you this evening were performed under ethyl chloride. This anesthetic, so suitable for children, gives an ample anesthesia for the operation, including the fixation of the splint. It is advisable to have present at the operation an assistant to prepare the cement and insert it in the splint, so that after the tooth is rotated the splint is ready for handing to the operator. The instrument that has been used in all these cases is a blunt pair of upper incisor forceps.

The site of operation having been prepared by means of painting with a 3 per cent solution of tincture of iodine, the patient is anesthetized. When the patient is ready, the alveolus is held firmly as for the extraction of a tooth, and the instrument applied. Frequently the instrument has to be passed up under the gum margin in order to reach beyond the convexity of the teeth, for in many cases the tooth has not erupted sufficiently for this convexity to be exposed. As soon as the instrument is sufficiently far up the crown of the tooth for a firm hold to be maintained, torsion is commenced. In many cases torsion alone will not move the tooth, and the inward and outward movement used in extraction, only with more care, is necessary as an additional help. While this part of the operation is proceeding, the assistant should be mixing the cement (in all cases Ames' oxyphosphate of copper has been used) so that at the critical moment the splint is ready to be handed to the operator to fix. The teeth should be cleared of blood as much as is possible, although from the point of view of the security of the splint on the teeth this does not seem to matter much. At first I endeavored to remove all traces of blood, and even dry with alcohol, but not only was this almost impossible, but, as I have just said, unnecessary. The splint should be forced well on the teeth in order to adjust the rotated tooth to the position recorded on the corrected model. All excess of cement should be carefully removed, and the splint held in position while the patient is recovering from the anesthetic. Usually two to three minutes is a long enough period for the splint to be maintained in position, as at the completion of this period of time the patient has ceased the struggling sometimes associated with recovery, and the cement is hard.

After-treatment.—It is advisable to see the patient on the following day in order to ascertain that no undue pain is being suffered, and again about

the fourth or fifth day. After this, it is unnecessary to see the patient again for some weeks, if promise can be obtained that immediate notice will be given if any trouble whatsoever is experienced. All the present cases were seen as nearly as possible once a fortnight, but this was for the purposes of x-raying, and to gain experience of their progress. For the first few days it is advisable to prescribe a mouth-wash, chiefly for the purpose of keeping the mouth, and particularly the neighborhood of the splint, free from foreign material. For this purpose hydrogen peroxide of a 5-volume strength has been used.

Removal of the Splint.—The splints have been removed after an interval of about three to four months. It must be borne in mind that, apart from the use of the splint to immobilize the tooth rotated, it serves also as a protection to the tooth during the process of mastication.

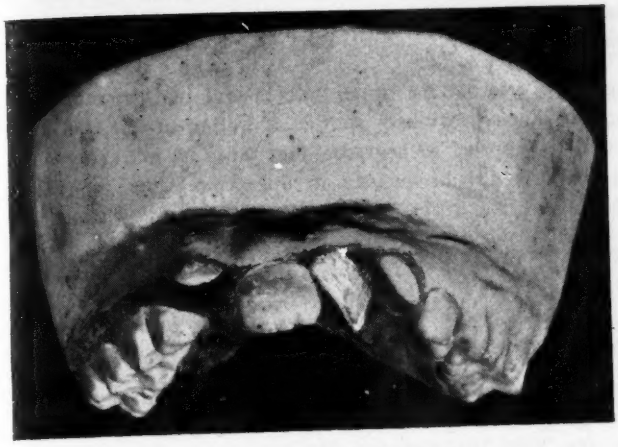
Just a few more words before I commence to show you the slides illustrating the cases. Those of you who in your private practices are able to carefully preserve your models, films and records may think it perhaps rather surprising that the cases that I show tonight are incomplete to a small degree regarding these important accessories. I will ask you to bear in mind that these are hospital cases, and that models, films and records cannot be carefully locked away so that the operator can be certain that he is the only individual to use them, but that they have to be so kept that operator, house-surgeon, dressers and others can have access to them at any time, and then not in a private consulting-room, but in a room populated by perhaps 200 to 250 people, including those well-intentioned but sometimes annoying people, the hospital cleaners.

The foregoing is a brief apology for my inability to show you the slides of one or two models and films that have disappeared during the period over which these cases extend.

CASE 1. A boy, Horace L., age 8 years. On October 23rd, 1920, immediate torsion of $\overline{|1}$ took place. Condition after operation was always satisfactory. Previous to operation a plate had been inserted to retract $\overline{|2}$ in order to make more room for rotation of $\overline{|1}$. The tooth was tested on November 3rd, 1921, and a very good response to heat was obtained. A radiogram of the tooth taken on October 8th, 1920, showed a well-opened apical foramen, and a radiogram taken on July 6th, 1921, shows the foramen almost closed.

CASE 2. A girl, Enid P., age 11 years. This patient had previously had an operation for a cleft palate. She was a very difficult patient to deal with owing to marked intolerance to anything placed in her mouth. The $\overline{|1}$ was rotated and outstanding, and the $\overline{|2}$ instanding with but little space between $\overline{|1}$ and $\overline{|3}$. The $\overline{|2}$ was extracted and $\overline{|1}$ was rotated by immediate torsion on February 12th, 1921, at the age of 12 years, 1 month. The splint came off on February 26th, 1921, and there was slight hemorrhage from around the tooth. On March 9th, 1921, the patient complained of slight pain in the region of operation, but this had disappeared a fortnight later. The tooth was tested later, but was found to be dead. For the reason mentioned above no films of this case were taken.

CASE 3. A boy, Reginal B., age 7 years, 2 months. Both central incisor teeth are abnormally large. Immediate torsion of $\overline{|1}$ took place on December 29th, 1920. On January 22nd, 1921, the patient appeared at the hospital with the splint broken; this was refixed on January 27th. From May 1st until the middle of June the patient was in hospital with scarlet fever. On July 29th the splint was removed. On September 1st the tooth responded

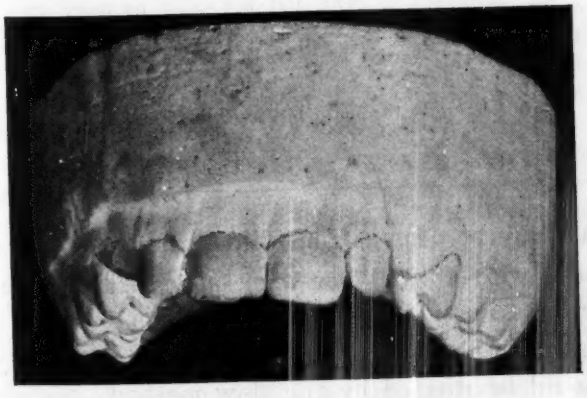


1

2 3 4

Case 1.

(The cross indicates the tooth moved.)



well to both heat and cold. A radiogram taken on November 1st, 1920, showed small development of the root, and subsequent radiograms taken until his discharge showed very well the gradual development of the root.

CASE 4. A girl, Violet H., age 10½ years. An upper left lateral incisor was rotated on November 18th, 1920. A radiogram taken previously showed a well-open apex. On November 3rd, 1921, the tooth was found to respond to heat, but not quite as markedly as the upper left central incisor. Radiograms taken subsequently to operation show gradual development of the root.

CASE 5. A boy, Charles S., age 9 years. An upper left central incisor tooth was rotated on April 23rd, 1921. The root was only partially developed. On July 12th, 1921, the splint was removed. On September 15th, 1921, the tooth was found to respond well to cold, but slightly to heat. Subsequent radiograms show gradual development of the root.

CASE 6. A boy, Eric T., age 12 years. An upper left lateral incisor was rotated on April 23rd, 1921. The tooth had a slightly open apex. On testing five days later no thermal response was obtained. On August 4th, 1921, the splint was removed. On November 5th, 1921, the tooth was again tested for thermal response but none was obtained. The tooth was slightly loose, and an abscess had pointed on the gum above the tooth. Radiograms taken subsequently to the operation showed the following changes: July 2nd, 1921, a lighter area around the apex of the root denoting bone absorption, which was not shown on a radiogram taken on July 16th, 1921, but which is shown on a radiogram taken on November 5th, 1921.

CASE 7. A girl, Monica L., age 9 years. An upper left lateral incisor was rotated on May 21st, 1921. Great difficulty was experienced in keeping the tooth in correct position previous to splinting. The splint was removed on September 27th, 1921, when the tooth was found to be slightly painful on pressure. A counterirritant was applied to the gum, and two days later pain had disappeared. On November 3rd, it was found that the tooth responded to heat, but not quite so well as the adjacent tooth did. The radiogram taken before operation showed a well-open apex, and those taken subsequently showed the usual development.

CASE 8. Charles S., age 9 years. The upper right central incisor tooth was rotated and brought forward on June 18th, 1921. On November 3rd, 1921, the splint was removed, and very well-marked thermal response was obtained. The radiogram taken before operation showed a well-open apex, and those taken subsequently showed its gradual closure.

TABLE OF CASES

PATIENT	AGE	TOOTH		CONDITION AFTER OPERATION (FIGURES REFER TO MONTHS)
H. L.	8	$\underline{\vert 1}$	12	Very good.
E. P.	12	$\underline{\vert 1}$		Dead.
R. B.	7 7/12	$\underline{\vert 1}$	8	Very good.
V. H.	10 6/12	$\underline{\vert 2}$	12	Responds to heat, but not quite as much as $\underline{\vert 1}$ does.
C. SH.	9	$\underline{\vert 1}$	5	Responds well to cold, but slightly to heat.
E. T.	12	$\underline{\vert 2}$		Dead.
M. L.	9	$\underline{\vert 2}$	6½	Responds to heat, but not quite as much as $\underline{\vert 1}$ does.
C. SD.	9	$\underline{1 \vert}$	5½	Very good.

The conclusions that I think may be drawn from these cases are:

(1) That an incisor tooth with a well-open apex may safely be rotated by the immediate method; and

(2) On the contrary, a tooth the root of which is fully or nearly fully developed should be rotated by the slow method.

In conclusion, gentlemen, I should like to render my thanks to Mr. H. M. Worth, the Dental Radiographer at Guy's Hospital, and also to my House-Surgeon, Mr. V. L. Sunderland, both of whom have given me invaluable aid in the preparation of this paper.

DISCUSSION

The President congratulated Mr. Bocquet Bull upon the very interesting series of models and of radiographs which he had shown. The subject of the immediate movement of misplaced teeth was one which, as Mr. Bocquet Bull said, had interested a certain number of dental surgeons for many years; in fact, he thought one might go back even further than the author of the paper had suggested, for one found that no less an authority than the French dentist Fauchard left it on record that in 1728 he performed the operation of luxating an incisor tooth into line. Some years ago he (the President) was encouraged to do the operation known as alveolotomy through the successful efforts of Mr. Sidney Spokes and Mr. Dolamore in the immediate movement of teeth, and whose work was published in the Transactions of the Odontological Society many years ago. Alveolotomy was different from the operation of immediate torsion to which Mr. Bocquet Bull had referred; but the dangers and risks involved in the immediate method were perhaps somewhat similar to those which the author had mentioned; though for his own part he was of opinion that the risk of failure in alveolotomy was less than with immediate torsion. It would be remembered that the term "alveolotomy" was given by Mr. Dolamore in the year 1899, when he read his paper on the subject before the Odontological Society; the operation consisted in dividing the bone on either side of the misplaced tooth and in bringing that tooth into the normal line of occlusion. Mr. Bocquet Bull had referred to several of the important points to be borne in mind when undertaking such an operation as immediate movement, and he (the President) wished to emphasize the great importance of asepsis in such cases—asepsis, that is, as far as it was possible to obtain it for operations in the mouth. The value of radiographs both before and after treatment was recognized by all who adopted these methods. In the operation of alveolotomy he had used the small alveolar saws which could be purchased from the depots, and for the movement of the tooth itself the forceps known as Grever's forceps. With those forceps he had employed a rubber pad to safeguard the tooth, so that it might not be forcibly moved out of its socket. He wished to ask Mr. Bocquet Bull whether he used some sort of pad as a protection against this mishap. Mr. Bocquet Bull had referred to one particular case in which that tendency had arisen. It had been suggested by some authorities that bony union did not occur in the maxillary bones after fracture; but for his own part he could not understand why the structure of the maxilla should be an exception to other bony structures. Of course, if the periosteum was torn and was allowed to remain between the fragments, then that would prevent union. He thought that the subject which Mr. Bocquet Bull had introduced was a field of surgical treatment of which the possibilities had not yet been exhausted and one which was worthy of further investigation.

Mr. F. St. J. Steadman, in thanking Mr. Bocquet Bull for his paper, said that he felt very serious doubt as to whether immediate torsion was justified or not. Certainly in cases over ten years the percentage of dead teeth that had been obtained was too high. Dead teeth, to his mind, were a very serious matter indeed, and in one case quoted this evening in which, after some months, Mr. Bocquet Bull removed the splint and found the tooth still tender, in his (the speaker's) experience, that tenderness remained. If the tooth remained tender for months while the splint was on, that would mean that the patient would subsequently avoid biting on that tooth, and peridontal disease would be set up. In that case he would feel justified in removing the tooth even after the trouble that had been taken to put it into the correct situation. Then with regard to the earlier cases, the driving of forceps up underneath the gum, right through the attachment of the gum to the alveolus into the dental ligament was an undesirable thing. The dental ligament would have been damaged, and sepsis liable to set in there; therefore he did not think the risk was justified. The tooth could be got into its normal situation by the slow method, and he felt

that if it were intended to do the operation by the quick method, one should have exceptional reasons for so doing. The risk was so great that, while thanking Mr. Bocquet Bull for his paper, he personally would not follow the practice which had been indicated.

Mr. George Northcroft said he would like further information on a point raised by Mr. Steadman with regard to the risk of the dental ligament owing to the forceps having to be placed high up on the tooth. He took it that Mr. Bocquet Bull did not place the forceps any higher than on the neck of the tooth, which was enamel; and therefore he did not quite see where the dental ligament came in, which was surely connected with the root of the periodontal membrane.

Mr. E. B. Dowsett said that the President had rather cut the ground from under his feet, because he had brought with him a rather ancient book, from which he wished to read a short extract. The extract was as follows:

"Some dentists have recommended in cases of this sort when the space between the adjoining central and lateral incisor is equal to the width of the deviating tooth, to turn the latter in its socket with a pair of forceps. It is scarcely necessary to say, that if a tooth is turned in its socket the vessels and nerves from which it derives its nourishment and vitality are severed, and though its connection with the alveolus may be partially re-established, it will be liable to act as a morbid irritant."

That was written in 1852 by Mr. C. A. Harris. He believed that that was as true today as in 1852. It was obvious that in cases after the apex was closed the pulps died, and therefore, as Mr. Bocquet Bull had said, such treatment could not be attempted; but even in the earlier cases, where the pulp still remained alive, and where, necessarily, one formed a dilacerated tooth, that portion of the peridontal membrane which was there at the time of the operation must necessarily be degenerated, because its tissues were severed. Therefore one would like to see records of the cases Mr. Bull had dealt with in the last year or so, not in 1921, but in 1941, and then one would perhaps know more how to deal with such cases in one's private practice. He was strongly of Mr. Steadman's opinion, in that he did not propose to adopt the practice amongst his own private clientele, as the risk was undoubtedly far too great, and such risks ought not to be run. He had now reached the stage of being old enough to see cases that he had regulated as long ago as twenty-five years, where pyorrhea had undoubtedly been caused by the regulation performed—and he did not think that he regulated them any more violently than anybody else. He had seen cases in the last few years of grown-up men and women whose teeth he had regulated as children, and they had developed pyorrhea. He had kept observations upon them during the whole period. He would like to hear the views of members of the Society as to whether they had had experience of similar cases, where the patients had grown up. He thought that such treatment as Mr. Bocquet Bull had described, which was very forcible, was of such a nature that it would be very valuable to have cases definitely recorded at periods of five, ten, fifteen, and twenty years hence. At present he was not at all satisfied that one should run the risks involved in the immediate movement of teeth.

Mr. A. T. Pitts remarked that there was one name which Mr. Bocquet Bull might have referred to in his short historical résumé—namely, that of Mr. Hopewell-Smith, who frequently used to move teeth by immediate methods when he (Mr. Pitts) was house-surgeon at the Royal Dental Hospital. In contradistinction to Mr. Dolamore's method, Mr. Hopewell-Smith used to say that he always made a greenstick fracture of the outer alveolar plate. Since he (the speaker) had seen the cases which Mr. Bocquet Bull had shown the Society some time back, he had been stimulated to do a few cases himself, and so far—though, of course, these were early days—the results had been satisfactory. With regard to what had been said about the possibility of injury to the dental ligament, that was a point to which he had always paid special attention and he did not think the forceps could be allowed to go even up to the neck of the tooth. He took an absorbent napkin and padded it between the blades of the forceps, so that the cutting edge of the tooth really rested on that pad, and the blade could not extend more than three-quarters of the way up the crown of the tooth. Although that necessitated a little more force on the tooth, it

could be done, and during the whole of the time the forceps did not actually touch the the gum margin. That certainly eliminated one possibility of infection and injury. Again, the cases he had done had been usually performed under a local anesthetic, although in the cases of very young children probably ethyl chloride would be better.

He had been interested to hear Mr. Bocquet Bull's figures with regard to the age of the children. There was no doubt, of course, that the open apex afforded the better chance, but he wondered whether in doing that, one might not cause a dilacerated condition of the tooth. It might not matter, perhaps, if one did, though if the tooth afterwards required treatment for caries it might provide difficulties for the operator. He had seen a case recently which had been done many years ago, but in that case the pulp had died, and the tooth had discolored very markedly. There was no doubt that in order to arrive at correct conclusions one must, as had been said have a long series of cases recorded over a very considerable period, because if there was any real risk of the pulp dying, or of the tooth remaining permanently loose, it was obvious that the operation was not justifiable; but for himself he was not prepared to take up the trenchantly denunciatory attitude of Mr. Steadman, and he actually proposed to do some more of such cases. One point which was worth laying stress upon was that the splint ought to be very thin, because it needed frequently some adjustment in the mouth, which could be done quite easily with forceps, whereas if the splint was at all thick it became difficult. It was not always possible to alter the position of the tooth on the model and to ensure that the tooth should accurately correspond with the tooth on the model.

Mr. J. H. Badcock said that as Mr. Dowsett had asked for the experience of twenty years, and as it was twenty years since Mr. Sidney Spokes did a considerable series of immediate operations—he could not remember whether they were torsions—it might be that Mr. Sidney Spokes had been able to follow up some of those cases.

Mr. Sidney Spokes said he was rather in a difficulty, because all his work in connection with the immediate movement of teeth was in the advancement of upper incisors over lower incisors, and his experience of torsion was not large enough to be put into the scale at all alongside that of Mr. Bocquet Bull's communication. He felt, however, that he would be inclined to fight shy of torsion. He was not at all satisfied with the few cases he had done. Unfortunately he had not a record of them, but, speaking of the past, the impression left on his mind was that immediate torsion was not a thing to be indulged in—and with regard to the future he had not much interest, except as to what other people did. His few cases of torsion were done in teeth which were older than those described by Mr. Bocquet Bull—in other words, there was an apex already formed. When one twisted round a tooth with a completed apex one really must expect to get trouble at the end of that apex; but with regard to the ordinary advancement of an ingrowing incisor over a lower incisor, he considered that that was one of the safest and simplest and most ordinary operations that one could undertake. As far as he could remember now, without having kept records of all of them, he did about a hundred of them—mostly in a large institution where he could get plenty of material; and in those hundred cases he did not think that any tooth died after the operation. He had been able to see a great many of those children two or three or sometimes four years afterwards, and to note the condition; and his strong impression was that after that interval no single tooth had succumbed. The teeth were all in very good condition, and the only trouble he had had on one occasion was a very slight chipping of the cutting edge of the tooth. That, he considered, was a perfectly justifiable operation; they were good, well-trained children leading a very healthy life. He had never regretted any of those cases, but with regard to torsion, if he were still in practice he would not do it. The results brought before the Society were valuable; but still, if he were in practice he would not treat a misplaced twisted tooth by that operation of torsion. He would not hesitate for a moment to advance a permanent tooth with Grever's forceps, and he had sometimes done both the central incisors at the same sitting—had advanced both of them side by side over the lower incisors, and he had a certain number of models which he would like to present to the Curator of the Society's Museum if he thought they were valuable enough to go on record. He did not

think it was reasonable to put those two operations side by side except for the purposes of comparison. The one was a very simple one, and the other was at least a doubtful one, and therefore they should not be put in the same category; they ought to be considered as quite separate and distinct from each other. One was the simplest dental operation anybody could be called upon to do, and the treatment results were very favorable; but the other, to which more immediate consideration had been given at that meeting, was regarded by him in the same way as his friend Mr. Steadman regarded it as far as the risks were concerned. He had never had any trouble about forcing the forceps underneath the gums in order to remove the tooth. In the immediate advancement operation there was no access to the external atmosphere whatever; one really got what was called a "green-stick" fracture; one felt the external plate give as the tooth inclined forwards. The gum had never been injured in any way and everything had settled down comfortably afterwards; and there was no reason why one should get any sepsis at all.

Mr. C. H. Housden asked Mr. Bocquet Bull a question with regard to the first case shown on the screen, as to what anchorage he had got. There did not seem to be very many teeth to anchor on with his splint, and he was not quite sure where he would put his anchorage in the models shown. He also wished to ask Mr. Bocquet Bull what he considered to be the best age at which to perform the operation, and also up to what age he considered it was a safe operation. He had had a case of a lady a few weeks previously in his own private practice who had two very discolored central incisors, and he had immediately asked her what had happened to them—had she had any treatment? They were perfectly sound on the crown, and she had had no treatment at all except when she was about eight years old, when she went to a French dental surgeon, and he had said they must be twisted. He twisted them, and he twisted one so much that it dropped on to the floor, and he put it back again. The left incisor was not so bad, and he twisted that and it remained in and did not come out. The upper right incisor was the one he started on first, and he was probably better at it when he tackled the second one! However, he (the speaker) had x-rayed the two central incisors after having opened up through both the crowns. The right central incisor had a very large canal, and the x-ray photograph showed the apex was not closed. On opening it up there was a tremendous amount of discharge, because the tooth was septic. The lady was about thirty-six years old. The tooth discharged very freely, and there was a sinus on to the gum margin. He opened up the upper left one, and found difficulty in getting to the pulp chamber. He drilled into the tooth until the patient felt it, and apparently that one had still a live pulp in it of very small calibre. He was not going to drill any further into the canal, because he was quite certain it was alive. That was the tooth which did not come out. The tooth which had dropped on to the floor was the one which became septic.

Mr. J. H. Badcock, in thanking Mr. Bull for his paper, pointed out that although the operation described had received a good deal of condemnation at that meeting, yet under a certain age Mr. Bull had had 100 per cent success. Above that age he had had 100 per cent failure, according to his figures.

Mr. Harold Chapman said he had understood Mr. Bocquet Bull to say that the splint should not go up in between the teeth at all. It struck him that it might be simpler—and Mr. Pitts also had hinted at it—that if, instead of the cap splint, bands were made to go round the teeth, and then the bands soldered together in the relationship that the teeth are to ultimately occupy, such a splint would take up very little room and not interfere with the bite, and also be more readily capable of adjustment than a cast splint might be. He thought Mr. Bocquet Bull had brought forward a phase of the subject which many members had never practised, and which they might now be encouraged to take up.

Mr. Bocquet Bull (in reply) first dealt with the President's point as to how the extrusion of the tooth by the forceps was avoided in most of the cases described. In one case he had mentioned that the tooth became quite loose in its socket, but he thought that was due to the fact that he had pulled it down rather much to attain its new position.

There was one other case where the tooth was very loose indeed; that also was the result of the same action. With regard to Mr. Steadman's and also Mr. Dowsett's remarks, Mr. Badcock had answered them for him. He had taken particular care to point out in his conclusions (1) "that an incisor tooth with a well-open apex may safely be rotated by the immediate method"—a conclusion which he had arrived at from the fact that those cases which had well-open apices were at present in quite a satisfactory condition, and (2) those that had more or less closed apices, and also (which corresponded with their age) had died. That was the very thing he wished to point out, and which he had stated later on: "A tooth the root of which is fully or nearly fully developed should be rotated by the slow method."

Mr. Steadman had referred to a tooth which was slightly painful, and which in his experience he believed would remain painful. In the particular case the pain did not persist, because a little while afterwards, after treatment with a counterirritant, it was perfectly comfortable, and had remained so for the following three months up-to-date.

In reply to Mr. Dowsett, he had already explained the difficulties of keeping records at a hospital; but, if he were alive in 1941, and the records were still accessible, he would bring them along.

In answer to Mr. Housden as to the retention for the first case, the case referred to was the rotation of an upper left central tooth. The anchorage was on the upper right central and lateral, and was shown on one of the models.

With regard to the question as to the best age at which to rotate the teeth, and beyond what age one should not go, he thought that so far as age referred to the closing of the apical foramen, it did not enter into the problem at all. It was a question of whether the root of the tooth was developed or not, and knowledge as to that could be quite well obtained by having x-ray photographs taken beforehand.

Mr. Chapman has mentioned the making of bands and their use as splints. He thought that was a very good suggestion, but the reason the splints were made in the manner shown was that one wanted the splint ready beforehand. He then asked Mr. Chapman whether he would go as far as to remove the tooth from the model and fix it in the desired position, and then make the bands to that model.

Mr. Chapman: No; make the bands in the mouth in the ordinary way, and then take an impression, and then treat the model exactly as you did to solder it together.

Mr. Bocquet Bull replied that there was not the slightest reason why that should not be done.

THE PLACE OF ORTHODONTIA IN SCHOOL DENTISTRY*

By R. Weaver, M.B., B.Ch., M.R.C.S., L.R.C.P., L.D.S.

IN READING the reports of the work of school dentists, one cannot help being impressed by the fact that the policies pursued at different school clinics, working under very similar conditions, vary widely. In view of the fact that dentistry, like the other branches of the healing art, is not a pure science, these differences are inevitable, and it would be a mistake to lay down any hard and fast rules as to what policy should be pursued. At the same time, there ought to be fairly general agreement on principles, and the differences should be confined to matters of detail and the methods of treatment. It is evident that, in the case of orthodontia, there is no agreement on general principles.

Contrast, for example, the two statements which follow. Mr. C. E. Wallis in his book on Dental Clinics, says, "No regulation work involving the use of apparatus should be carried out except such as can be performed by judicious extraction or the use of immediate regulation forceps." The report published in a recent number of the Journal states that, at the Northampton School Clinic, "there were thirty-seven regulation cases, not merely extractions to remedy overcrowding, but cases which took from one to six months to bring the teeth into alignment."

At first sight it would seem impossible to justify both these statements which apparently contradict one another. But it will, I think, be agreed that the authors were both animated by the same principle, namely, to secure "the greatest good of the greatest number," and equally agreed that it is for the individual dentist to decide whether extraction or mechanical treatment is likely to produce better result. The fundamental disagreement is as to whether these cases should be undertaken at all, and there are several factors which have a bearing on the question.

It is probable that the varying policies depend in many cases on the attitude of the dentist towards this kind of work. Orthodontia is a subject which seems to inspire either enthusiasm or positive dislike; there are very few who are quite neutral towards it. Nothing of much value would be gained by expecting those who dislike it to undertake the work on anything but the most modest scale; their successes would be negligible. On the other hand, many men welcome a certain amount of it as a relief from the rather monotonous routine of the ordinary clinic work. In so far as it tends to raise efficiency by adding variety and interest to the work, and thereby possibly leading to less frequent changes in the staff, this aspect should not be entirely ignored. It must be confessed, however, that this consideration is not, generally speaking, a very potent one.

*Republished from The British Dental Journal, April, 1922.

Another factor is the value of orthodontia from the standpoint of propaganda. Every school dentist is frequently consulted by parents about the correction of irregularities. If he can do anything which will raise him in their estimation and succeed in dispelling the too prevalent idea that he is a mere extractor of temporary teeth, he is doing something of great value, quite apart from the intrinsic value of the work itself. The parents may or may not believe in the results of oral sepsis, but they do believe the evidence of their own eyes, and a successful orthodontic result will in every case convince them that the dentist knows what he is talking about. Until parents clamor eagerly for the treatment of their children's teeth, we can scarcely afford to ignore this form of propaganda, but it must be kept within reasonable limits.

Every school dentist knows that he must limit this work rather stringently. For each parent who consults him about a child's health, there are probably several asking for advice about the treatment of an irregularity which may be mainly an esthetic defect. In many cases, he will not feel justified in spending the necessary time on the treatment, but it is not a very satisfactory way out of the difficulty to tell the parents that the health of another child is more important than the appearance of their own. Outwardly, for politeness' sake they may acquiesce, but in their hearts they do not believe it. Generalized statements are safer, so one lays it down as a dogma that a child's appearance is not a matter of Public Health, and that the community cannot be responsible for a matter of personal appearance.

Nevertheless, when making such a statement, I feel that at some time it may be challenged. The parents may never (dare I say it?) have heard of George Bernard Shaw, but they may be imbued with the spirit of the teaching laid down in his preface to "The Doctor's Dilemma." There these words appear, "Be careful to go to a school where there is what they call a school clinic, where your nutrition and teeth and eyesight and other matters of importance to you will be attended to. Be particularly careful to have this done at the expense of the nation, as otherwise it will not be done at all, the chances being about forty to one against your being able to pay for it yourself, even if you know how to set about it."

We have travelled a long way from the time when Malthus laid it down that no man has any claim on society for even subsistence if his labor will not produce it, and it is now the fashion to demand at the expense of the community anything for which one cannot pay directly.

As a matter of fact, the parents could make out quite a good case on two grounds. In the first place, the child's appearance is not a matter of indifference. Any school dentist would be right indignant if the local authority asked him, on the grounds of economy, to put a copper amalgam filling in an anterior tooth, even although the original cavity were equally black. In the second place, our work is not, strictly speaking, Public Health work, and it will be necessary to examine wherein lies the difference.

The Medical Officer of Health is usually, but not necessarily, School Medical Officer, and at the present the medical service is not under the Ministry

of Health but under the Board of Education. Public Health authorities are not expected to devote themselves, to any great extent, to the treatment of disease, and where they have done so, as for example at Bradford by establishing a municipal hospital they have aroused a storm of protest. On the other hand, school medical authorities undertake the treatment of numerous cases of noninfectious disease, including such matters of personal appearance as nevi. Their powers are very wide and at present there is a dispute at Willesden as to the scope of the school medical treatment, the local doctors protesting that it is too wide.

If we are to decide what is to be done about orthodontia, the real question is not what individual parents would like, or what the dentist would like, but what his employers, in other words, the community as a whole, would like. He is paid to advise the representatives of the community and to carry out their wishes, and, provided these representatives take an enlightened view of things, their wishes must decide the matter.

The cases of irregularity which one sees may be roughly divided into three groups.

1. Those where the irregularity can be easily corrected by trivial operation such as the extraction of one tooth. There will, I think, be general agreement that these cases should always be treated.

2. Those where the irregularity is so marked as to seriously reduce and endanger the efficiency of the masticating apparatus. Most of us would probably agree that every effort should be made to improve these cases.

3. A large intermediate group. This includes those cases where the defect is much more serious from the point of view of appearance than of efficiency. As an example, I may mention the fairly frequent cases of rather prominent canines, where it might require "one to six months to bring the teeth into alignment." Is the dentist to advise that this group should be treated or not?

I am not unmindful of the fact that the orthodontist will probably assure us that every case of irregularity is a source of danger to the whole denture, and that by treating these cases we may help to prevent trouble later on. The ordinary dentist, feeling that in a considerable number of these cases the danger is almost negligible, will probably say that in the time at his disposal it is better to treat (say) ten cases of established caries rather than one case of hypothetical caries. As a matter of fact, the local authority, wishing to see an imposing array of figures in return for its money, would in most cases agree.

On the other hand, some one might say that surely prevention is better than cure. This is true, but the terms prevention and cure are only relative. The treatment of caries is not an end in itself; it is only a means to an end. In other words, it is the prevention of more serious disease.

Under present conditions, therefore, the cases in Group 3 should be let alone. If the staffs of the clinics were adequate, what then? It becomes a question of politics rather than of dentistry, and will be decided by the view which the local authority takes of its duties towards those whom it represents.

REPORT OF CASES*

By Dr. Harry E. Kelsey, Baltimore, Md.

I HAVE to make an apology in the beginning for a misunderstanding with regard to the cases I am to show. I promised Dr. White I would show two or three cases. He put me down for three, and two of them are Class II. I did not understand these were to be selected. Dr. White asked me to show cases of which I have casts taken several years after treatment. I will show you one Class III case of which the last casts were made after a lapse of five or six years since the treatment was finished.

The case I am to show was one of the most exaggerated Class III cases I have ever attempted to treat, especially in view of the fact that the patient was about twenty years of age.

Fig. 1 shows the original casts and those taken a few months after the treatment was completed. The appearance of the original casts indicates clearly that they were made before I had learned the value and satisfaction of properly trimmed models.

Fig. 2. This is simply a copy made from my original casts properly articulated and trimmed, giving in addition an occlusal view. Looking at the slide you will see a premolar and first molar were lost on the left side, and a first molar on the right side. These teeth were extracted to correct this malocclusion. I suppose, when the patient consulted a dentist for treatment the dentist immediately said to himself, "What teeth shall I extract?" He doubtless thought he had to extract some of them, there being at that time overlapping and crowding of the anterior teeth. The result was possibly a little better alignment of the anterior teeth, but the spaces were closed up and the arch diminished in size.

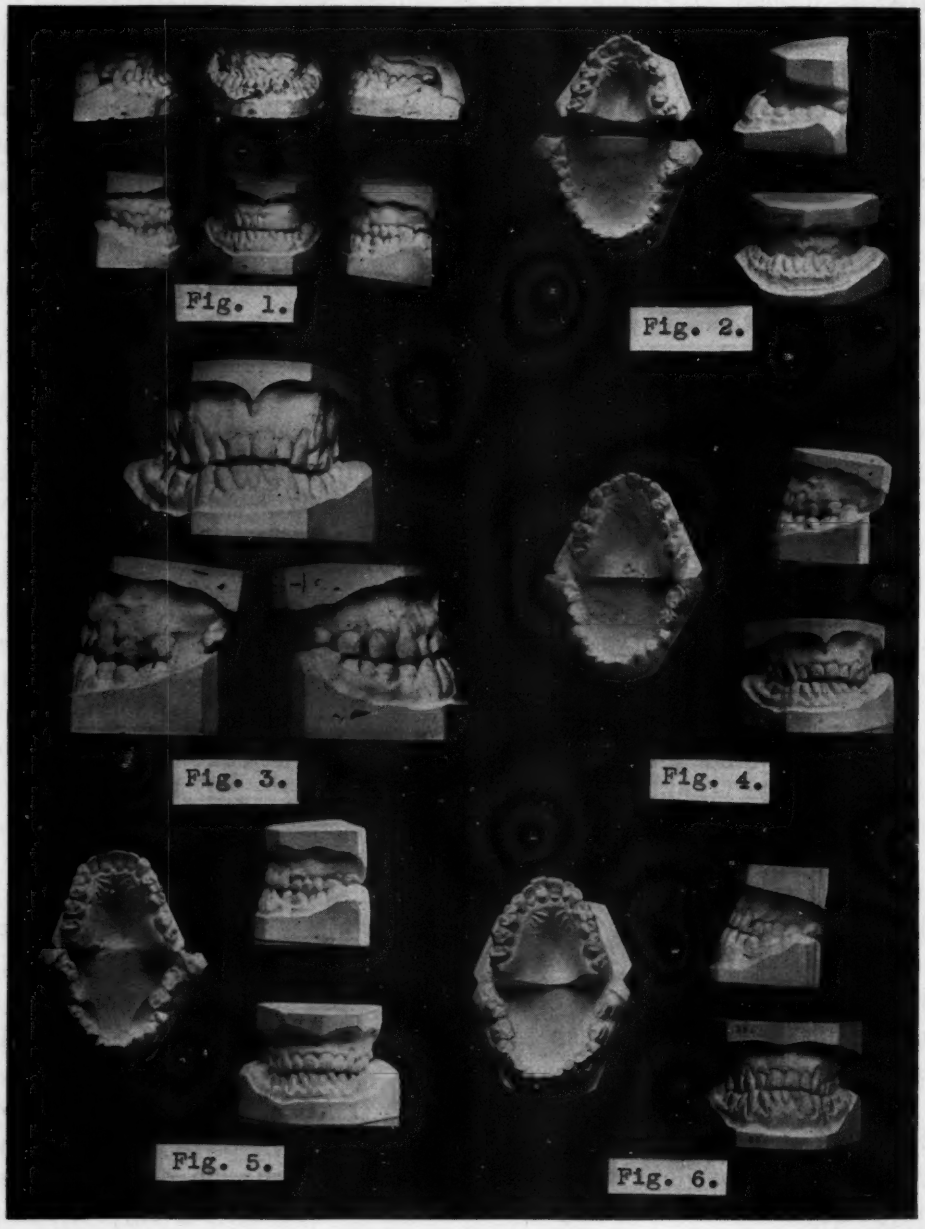
Fig. 3. The plan of treatment I adopted in this case was to restore as much of the space as I could at the same time correcting the mal-relation of the arches. This was a good many years ago and to some extent was experimental. I put on the usual intermaxillary elastics with the old E arches and used ligatures. It was before the day of the pin and tube appliance, and I did it with such appliances as we had at that time. After about a year or more I had succeeded in bringing about this result.

You will see there has been some space secured on the left side, and a little retaining appliance was put there with a spur to hold it, and later the same thing was done on the right side. The relation of the arches, I think you will agree with me, has been corrected pretty well, considering the patient's age and the loss of tooth structure in the maxillary arch. At this time I felt very much encouraged. Two of the anterior teeth were devitalized before he came to me; there was caries and considerable destruction of tooth tissue, and at an early age he must have worn his front teeth before there was protrusion of the mandibular arch.

*Presented before the American Society of Orthodontists, Atlantic City, N. J., April 27-30, 1921.

Fig. 4 represents the case a little farther along, and shows that the alignment of the mandibular teeth is not exactly what it should be, yet it was progressing, and there has been quite a little more space secured between the maxillary premolars and molars.

Fig. 4 represents the case at the same time as the other slide, but shows



the occlusal view. You will see the spaces gained on both sides where teeth had been lost. The object was to protrude the anterior teeth with the molars and intermaxillary elastics as anchorage, thus enlarging the arch and carrying it forward at the same time.

Fig. 5 represents the case at a later stage when I had succeeded in getting as much space where teeth were lost as seemed practicable. I had as good alignment as seemed possible and had secured fairly good mesio-

distal relation of the teeth, but owing to the enormous width of the mandible I did not succeed in getting the maxillary teeth into a perfectly normal bucco-lingual relation and the position of the mandibular teeth in relation to the maxillary teeth was not exactly what one would desire. At the same time, he was leaving the vicinity of Baltimore and I had to bring it to a conclusion, as his business and other matters prevented him from giving more time to it. I sent him to an excellent dentist and he put in two restorations, one between the premolar of the right side and one between the canine and second premolar on the left. He also cut off four anterior teeth, two of which were devitalized at the time, and put crowns on them. This gave the man a very good looking set of teeth and very greatly improved his appearance. At the time he came to me his speech was very indistinct owing to the great projection of the mandible and the tipping of the maxillary anterior teeth into the cavity which the tongue ordinarily occupies, so that one could not readily understand him. It was not easy for me to carry on a conversation with him. By the time the teeth were in this position he spoke as distinctly as the average person.

Fig. 6 represents the same case a little over five years after the one you saw last. That was taken a few months after the dentist had made the restoration, and this about five years later. Careful examination shows there is a slight narrowing of the maxillary arch, but the mesio-distal relations have not changed which in conjunction with the fact that the patient is now a successful business man and is thought to have a good looking mouth and set of teeth may make such an exaggerated case worth showing in connection with the subject of permanent results.

LOCKING DEVICE FOR LINGUAL ARCH*

By Horace L. Howe, D.M.D., Boston, Mass.
Instructor in Orthodontia, Harvard University Dental Department

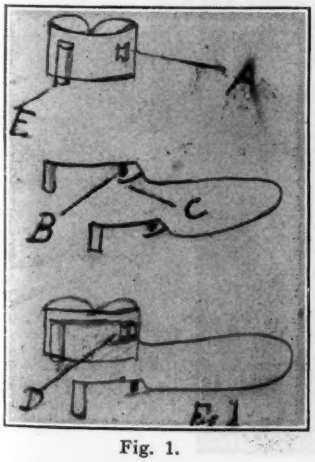


Fig. 1.

A LOCKING device which the writer has found quite strong without some of the disadvantages of the earlier types, is shown in Fig 1.

A short piece of half-round tubing is shown at *A* which is grooved upon its upper and lower surface. *B* is a post (which need not be of accurate fit of *A*). This post engages in the tube *A*. (This aforesaid post I have added since the meeting at Atlantic City.)

C is an 18-karat gold wire of 19-gauge which securely locks the arch when pushed under the grooved tube as shown at *D*. With this lock the tube *E* may be longer because it has no wire below that would injure the gum tissue.

Also the lock is nearer the front of the arch which gives greater stability.

*Clinic given before the American Society of Orthodontists, Atlantic City, N. J., April 27-30, 1921.

CASE REPORT*

By Allan Holman Suggett, San Francisco, California

THIS case shows appliances for moving impacted canines. The base wire is adjusted lingually of the impacted canines and may be straightened out to follow them as they are moved by the springs attached to the base wire.

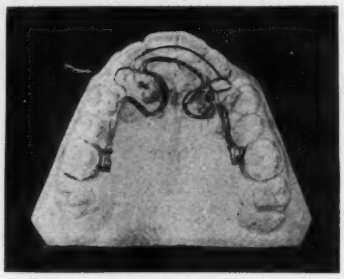


Fig. 1.

REPORT OF CLASS II CASE EIGHTEEN YEARS AFTER TREATMENT†

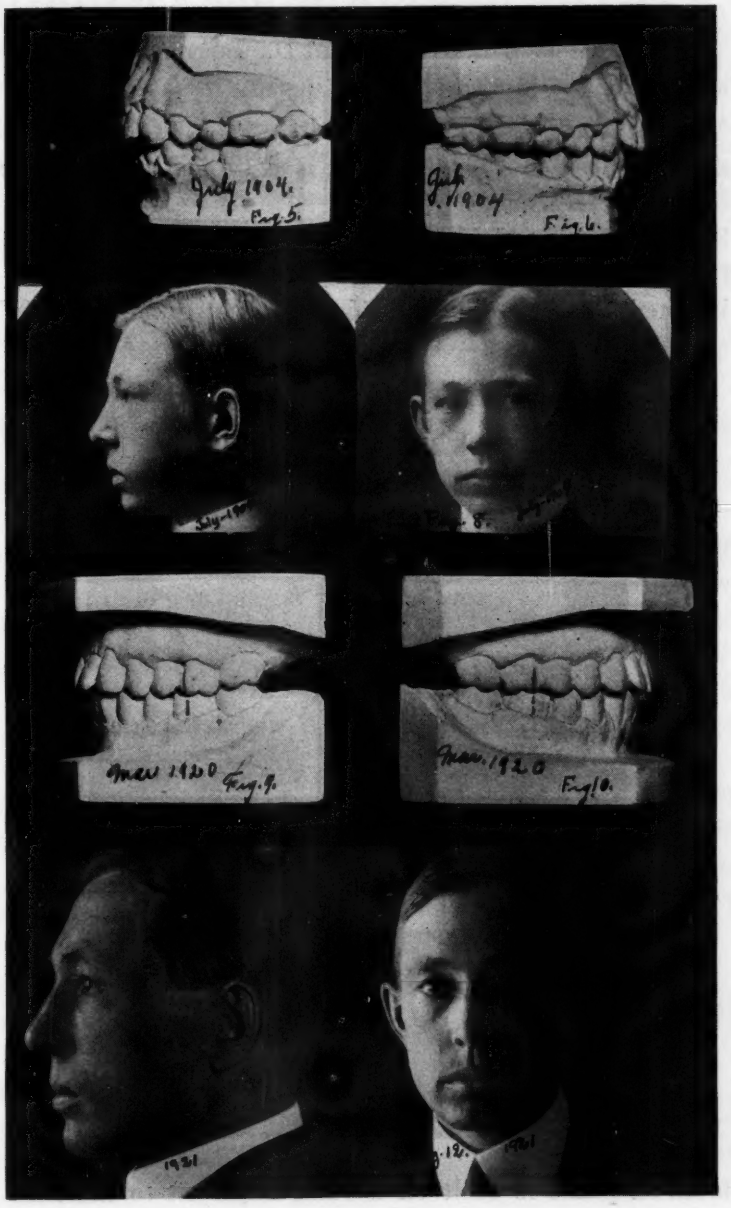
By Horace L. Howe, D.M.D., Boston, Mass.
Instructor in Orthodontia, Harvard University Dental Department

THE models illustrated in Figs. 1 and 2 are of a typical case of Class II before treatment. The models were made in October, 1903.

*Read before the American Society of Orthodontists, Atlantic City, N. J., April 27-30, 1921.
†Read before the American Society of Orthodontists, Atlantic City, N. J., April 27-30, 1921.

Photographs taken at that time are shown at Fig. 3 and 4.

The case was treated with intermaxillary elastics in the usual manner and the models shown in Figs. 5 and 6 were made in 1904. Photographs taken at the same time are shown at Fig. 7 and 8.



The models shown in Figs. 9 and 10 were made in 1920. The occlusion has remained in its corrected position. The improvement in the facial lines may be seen in comparing photographs 11 and 12 with Figs. 3 and 4.

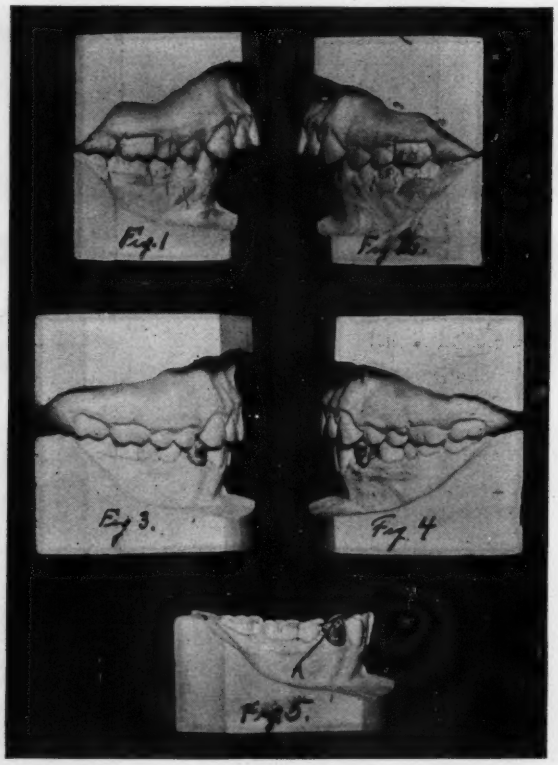
INCLINED PLANES FOR RETENTION IN CLASS II CASES*

By Horace L. Howe, D.M.D., Boston, Mass.
Instructor in Orthodontia, Harvard University Dental Department

THE case illustrated in Figs. 1 and 2 is a typical case of bilateral distal occlusion before treatment.

Figs. 3 and 4 show models of same case after treatment.

As an aid to maintain these cases in normal occlusion the writer has found an inclined plane as illustrated in Fig. 5 at *A* most helpful.



This inclined plane is built on a band adjusted to the first mandibular premolar made to occlude in front of the palatal cusp of the first maxillary premolar above.

Those who have treated Class II cases know how often the occlusion is inclined to slip back to its distal condition.

These inclined planes as well as inclined planes upon the maxillary molars, I have used for eighteen years with much satisfaction.

*Clinic given before the American Society of Orthodontists, Atlantic City, N. J., April 27-30, 1921.

DEPARTMENT OF
ORAL SURGERY AND SURGICAL ORTHODONTIA

Under Editorial Supervision of

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SOME POINTS OF TECHNIC IN CLEFT PALATE SURGERY

By Joseph A. Pettit, M.D., F.A.C.S., Portland, Oregon

Professor Clinical Surgery, North Pacific College

IT IS assumed, and possibly not incorrectly, that the unusual degree of vascularity of the tissues of the oral region spells a greater degree of resistance to infection, and at the same time greater proclivity for prompt and primary union of surgical wounds. The conclusion is logical: that the degree of resistance to infection is in direct ratio to the degree of vascularity of a part. It is a pathological entity that vascularity favors the production of healing by scar tissue.

In the oral cavity, there seems to be a greater degree of immunity to the ordinary low-grade microorganism. It is assumed this is due to the establishment of a local immunity by reason of the continued presence of this type of low-grade microorganism in the oral cavity, as well as to the natural resistance derived from the vascularity of the parts.

In view of the foregoing successful union occurs early, if it is going to be a successful union. It is usually possible to remove the coaptation sutures in six to seven days. The retention or supporting silver wire sutures are usually best left in a few days longer, in order that they may continue to exert their restraining influence over the muscle pull.

Within the province of this paper, it is not intended to take up any consideration of the mooted etiologic factors concerned in the cause of cleft palate. In this connection it is only desired to draw attention to, as well as emphasize the fact, that in most cleft palates the deformity does not represent so much the lack of soft tissues and bone structure, as a displacement of soft tissues and bone structures. Whether this displacement is a result of the failure of the embryonic processes to unite, or whether a primary displacement prevents the proper union, matters not. The average defective palate presents the analogy, wherein a sufficient amount of tissues for a flat roof

having been produced by nature, by some process the direction is changed so as to assume the form of a gable roof. By reason of the direction being changed to an upward obliquity, there is left at the top a gap, the width of which is in direct ratio to the degree of obliquity. In some instances there apparently exists a certain deficiency of tissues, especially in very young babies, which deficiency, as a general rule, will lessen as the child reaches the age of two years or more. With this fact in mind, proper reconstruction endeavors to transfer sufficient tissue from the gables in order to construct a so-called "flat-roof" for the oval cavity. The early operative procedures in this region were not carried out on this basic principle, and therefore the early successes were meagre compared with the results of present day palatal surgery.

A study of the ordinary cleft palate will disclose the fact that on either side, the palate processes of the superior maxillary bones and the horizontal plates of the palate bones are situated in a semivertical position instead of the normal horizontal position. Measurement of the width of each ledge will usually disclose the fact that the combined measurement is adequate, or nearly so, to bridge the roof of the mouth in a horizontal direction. This measurement at

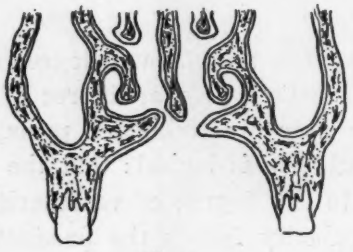


Fig. 1.

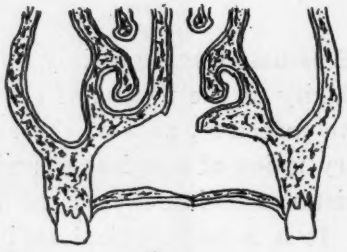


Fig. 2.

Fig. 1.—Mucoperiosteal flaps in the horizontal position to span the gap.
Fig. 2.—Obliquity of cleft gives adequate flap.

once discloses the degree of facility or difficulty to be encountered in an attempted repair.

In making preparations to construct the new horizontal roof of the oral cavity, it is necessary to give consideration to two rather important features. First, the tissue flaps transferred must have adequate nutrition to maintain their integrity; second, the tissue flaps must be of adequate substance to form a roof equal to the stress and strain required for this important boundary of the oral cavity.

It has been proved that if the tissue flaps to be dropped down are composed of the mucosa, the submucosa and the periosteum of the undersurface of the palate processes, undisturbed in their relationship to each other, a new structure is formed thereby of a thickness and strength adequate for all the requirements of nature. Undoubtedly the transferred periosteum reproduces enough osseous tissue to give perfect firmness and strength. The circulation of the palate, upon which we must depend for its integrity, comes from two sources: namely, the posterior palatine arteries emerging from the posterior palatine foramina, in the suture line between the horizontal plate of the palate

bone and the posterior border of the palate process of the superior maxillary; and from the nasopalatine artery emerging from one of the openings in the anterior palatine foramen, situated in the suture line between the palate processes on either side at a point where they join with the alveolar arch. In complete cleft palates this anterior blood supply may be disturbed or absent. Another source of nourishment, not to be depended upon, is from

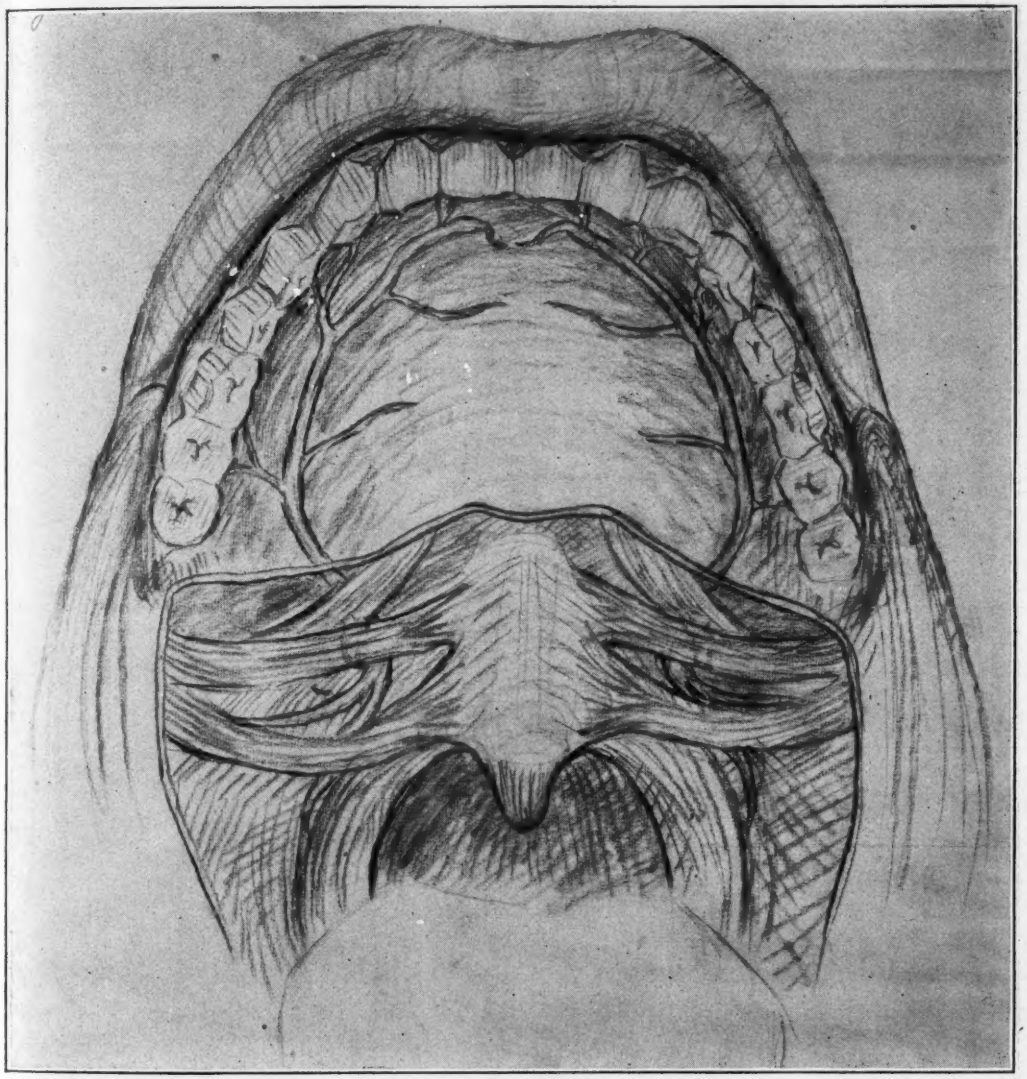


Fig. 3.—Palate vascularity and musculature.

the anastomosis with tiny vessels derived from the continuity of the alveolar soft tissues anteriorly and laterally, and from the pillars of the fauces posteriorly. The posterior palatine artery encircles in a groove the periphery of the hard palate at its junction with the base of the alveolar process. The avoidance of injury to this vessel in elevating the periosteum requires a combination of tactile skill and some good fortune.

Tension of any degree is inimical to the union of a palate suture line.

This not only applies to the posterior but it also applies to the anterior portion of the sutured cleft palate. If an approximation without tension does not occur, the flaps are dropped down, and elevated laterally, going over the alveolar process, in order that a free apposition may be secured. If the edges are drawn together by tension sutures, these sutures will not hold an

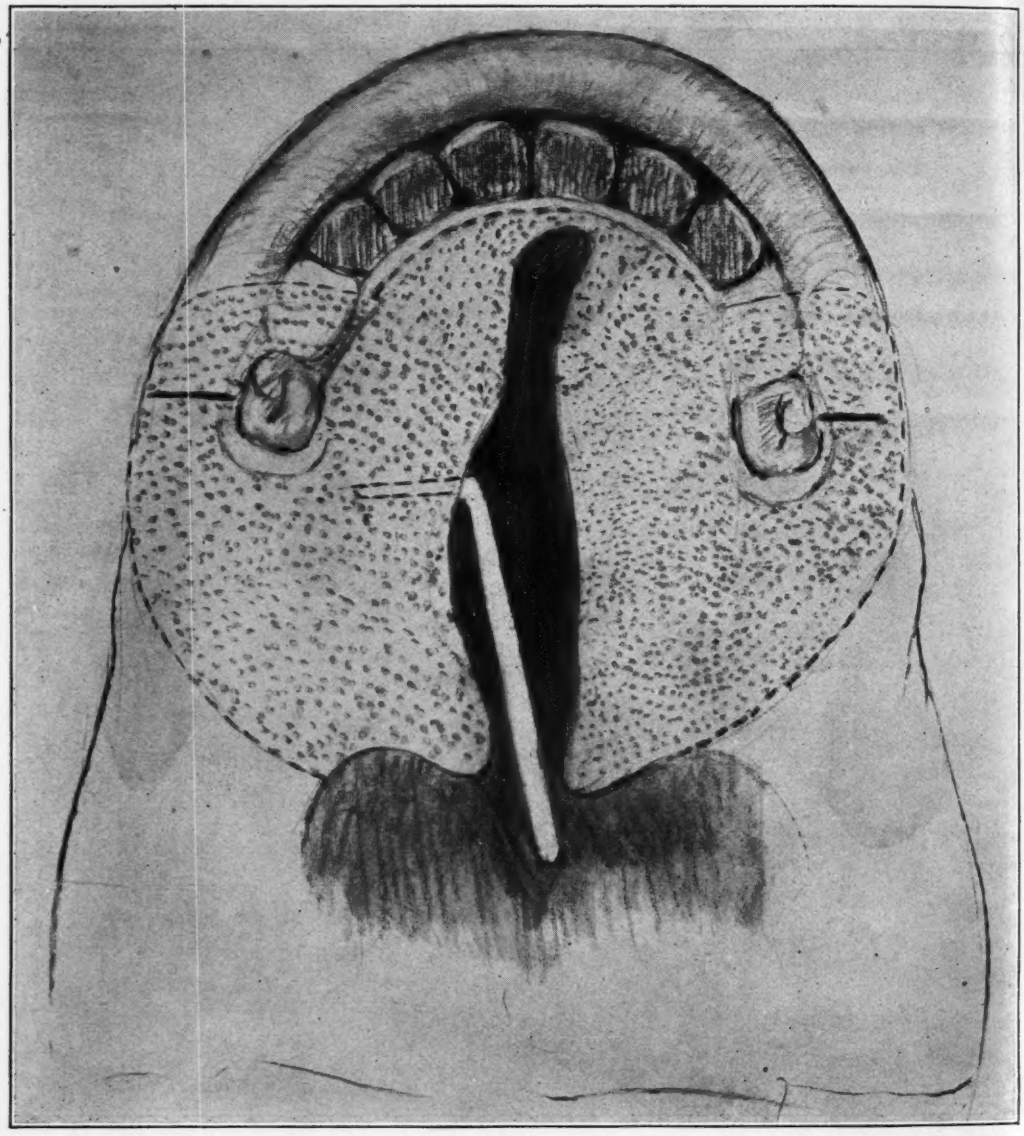


Fig. 4.—Elevation of lateral tissues to gain free apposition of edges.

adequate length of time for union, since they readily cut through the tissues by "pressure necrosis," and failure of union invariably ensues.

In considering the suture of the posterior portion of a palatal cleft, another source of tension requires consideration. This is the contraction pull of the palatoglossus and palatopharyngeus muscles, composing respectively the anterior and posterior pillars of the fauces. Even though the tissues of the soft palate and the posterior extremity of the hard palate lie in perfect

and easy apposition under anesthesia relaxation, each act of crying or swallowing on the part of the child produces a pull through these muscles upon the line of suture. This constant intermittent traction on the coaptation sutures will inevitably disturb the coaptation of the suture line.

This factor is overcome by placing a device posteriorly which takes up the strain of each muscular contraction and protects the coaptation sutures. Two or three annealed silver wires are passed through the muscular velum some distance from the suture line, fastening them on either side to a prop-

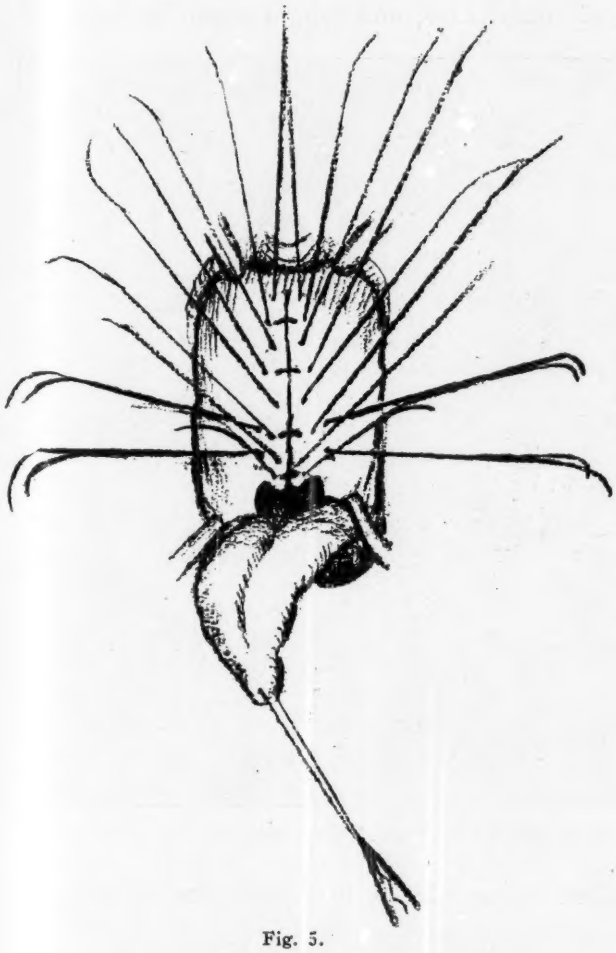


Fig. 5.

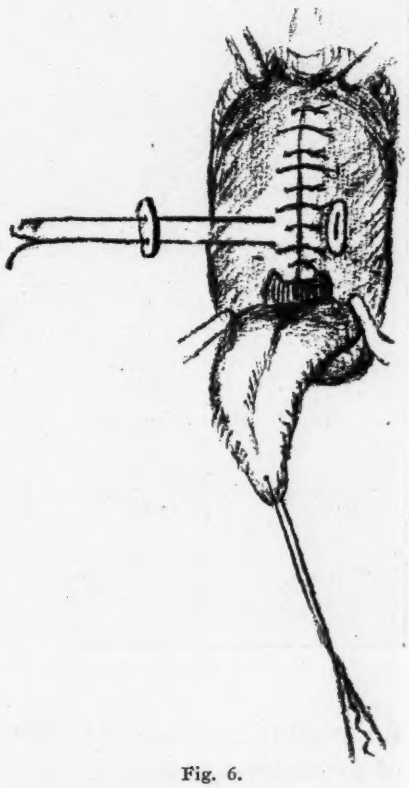


Fig. 6.

Fig. 5.—Silver wires and horse hair sutures (partly Fig. 8) united.
Fig. 6.—Lead plate splints being placed on palatal muscles.

erly constructed lead plate through perforations therein. This can better be described by the illustrations accompanying this article than by pen description. The silver wire sutures are drawn up to a point of tension, whereby a slight bulging of the suture line is produced. The lead plates serve a double purpose. First, they act as a splint on the muscles; and, second, they prevent the wire sutures from cutting through the soft tissues during tension of muscular contraction, by reason of the broad surface presented to the soft tissues.

It is only intended in this paper to take up certain of the details of cleft palate surgery, and not to go minutely into the entire procedure. The operation requires instruments of a type suitable for the tissues to be handled and the cavity in which the operation is performed. A facile elevation of the mucoperiosteal flap is only accomplished with elevators of special shape. The so-called fishhook needles permit the return stitch to be made with greater ease and more accuracy than the ordinary curved needle. The horsehair used must be of the best quality and strength and should be securely tied, but without too great a degree of tension. The lead plates are made of a size and shape to fit the individual case, and long enough to "splint"

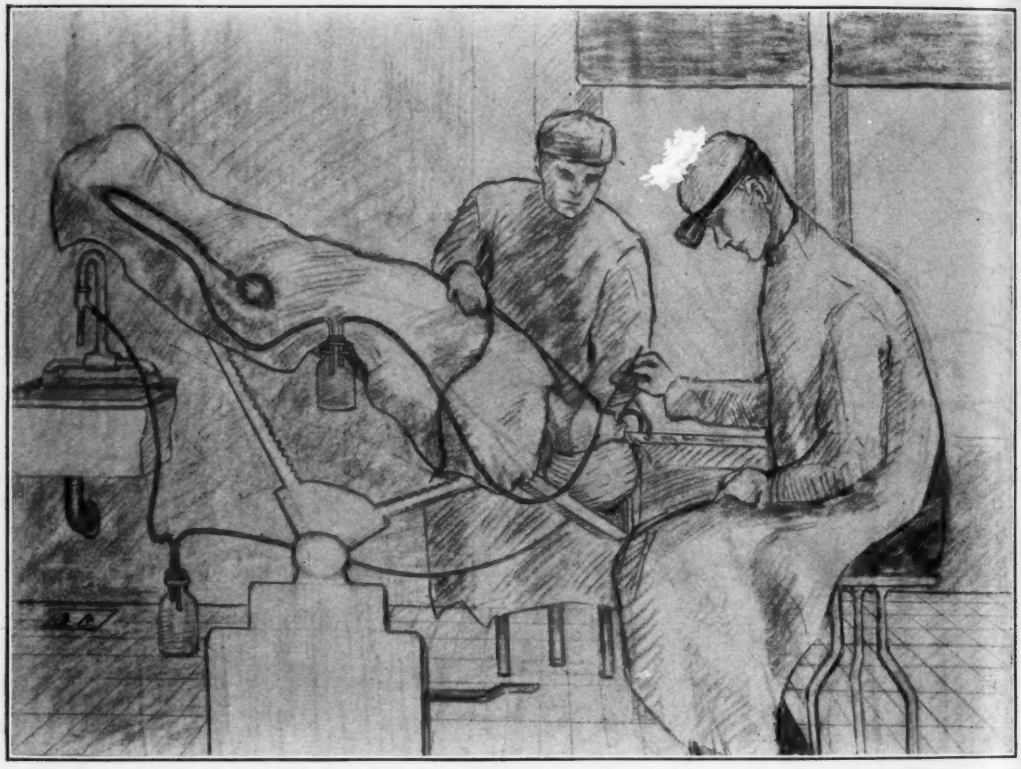


Fig. 7.—Advantageous setting afforded by Trendelenburg position.

the palatal muscles. The annealed silver wire is best used double and not of too large a gauge.

We have always felt, with many others, that ether is the safer as well as the more logical anesthetic for this type of operation, even in the very young. A deep narcosis is usually unnecessary, as the child can be kept under lightly most of the time. The nicety of chloroform anesthetic cannot be denied. In the hands of an experienced anesthetist it may be safe.

It is desired to emphasize at this time the "stage setting" for this procedure as well as for other surgical procedures in and about the oral cavity. Certain details have been carried out by us for many years in our clinic work which have especially facilitated the procedure of this type of surgery, as well as the safety of the patient. Fig. 7 is possibly more descriptive than words.

First.—With the child placed in the extreme Trendelenburg position, the advantages of this position are obvious. All of the blood gravitates into the nasal cavity and none goes into the pharynx; therefore, the child will neither swallow nor aspirate blood into the larynx. No vomiting of blood occurs following operations performed in this position, and the danger of aspiration pneumonia is eliminated. The blood can then be readily sponged

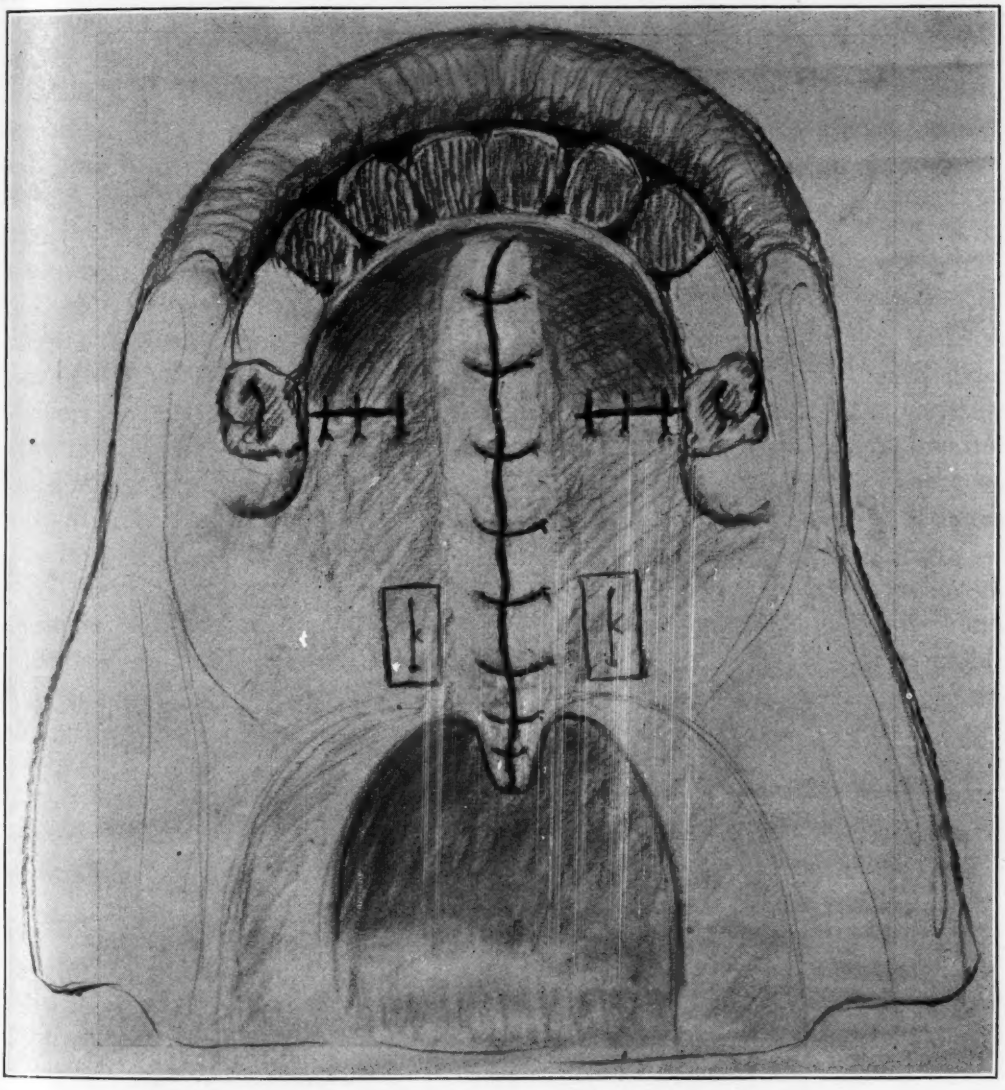


Fig. 8.—Obtaining additional tissue by going beyond the alveolar process.

away, or constantly removed without the bother or time loss of sponging by the "sucker" appliance as described below.

Second.—The operator sits upon a stool and looks directly down upon his field of operation. This position gives the operator a comfortable position to occupy during this tedious procedure, and at the same time to some degree at least puts his operative field before him on a "flat" surface. With his headlight the field of operation is always provided with ample illumination.

This illumination is constant and free from any disquieting shadows. The operator and headlight occupy a minimum amount of space, thereby enabling him to make available a greater amount of assistance by others.

Third.—A rubber catheter which is passed into one nostril and attached to a "sucker" removes the blood from the nasal cavity as rapidly as it is spilled, thereby keeping the operative field clear from this impediment to rapid work, and reducing the necessity of sponging to a minimum. Some

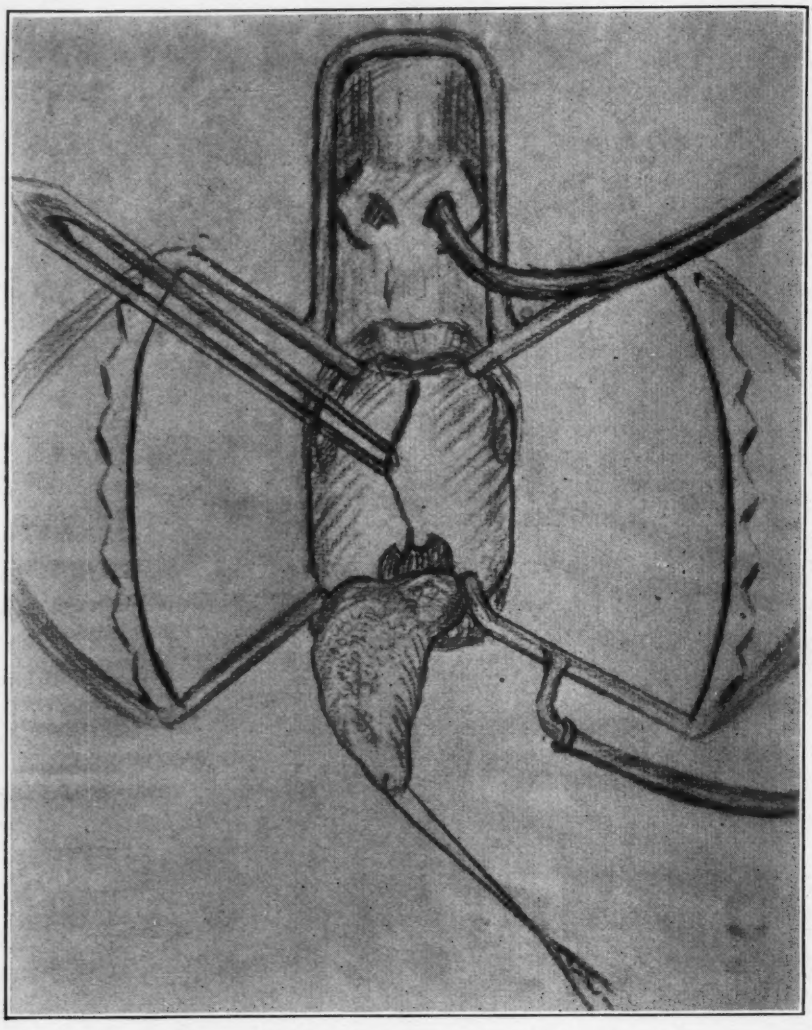


Fig. 9.—Adequate tissue: the results of extensive undermining.

of these operations have been performed from beginning to end without the use of more than half a dozen small sponges.

Fourth.—An assistant with one hand adequately keeps the tongue out of the way by a suture through the tip of the tongue.

Fifth.—The anesthetic is given by means of the conventional blower and the anesthetist is entirely out of the way.

The time for the repair of congenital defects of the oral cavity has been a matter of considerable difference of opinion. As time goes on it is more

generally conceded that the earlier these procedures are carried out, the better it is for the child.

The hare lip operation should be done very early in infancy for many reasons. First, this facilitates the child's ability to nurse and secure a reasonable amount of nourishment. Second, the reconstruction of the lip with the fibrous bands across the alveolar process is an important factor in narrowing the cleft of the alveolar process directly and of indirectly drawing together the two superior maxillary bones by narrowing the entire length of the cleft part of the cleft hard palate.

The cleft palate operation should without question be performed before the child acquires the habit of imperfect speech. The procedure on a healthy baby produces but little shock and the mortality is extremely low. If the cleft is especially broad, and on this account it is necessary to secure flaps from over the alveolar process and even from the side of the cheek, it is necessary to secure flaps from over the alveolar process and even from the side of the cheek, it is very advantageous from a surgical standpoint to carry out this procedure before the lateral teeth erupt. We have done it after the teeth have erupted and cut new openings in the transposed flaps for certain teeth, with success but not without great difficulty. Accompanying Figs. 8 and 9 illustrate this method of securing additional tissue for the flaps, when they are inadequate in size to bridge over the cleft. The consideration of these principles is not in the province of this paper, and therefore is only briefly mentioned.

The judgment of the surgeon and the attending pediatrist must make the decision of the exact time for operation in individual cases. The wisdom of refraining from operating on a child with malnutrition or poor physical condition is obvious. Each case must be considered individually and weighed on its own merits.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

Edited By
Clarence O. Simpson, M.D., D.D.S., and Howard R. Raper, D.D.S.

SOME PROCEDURES FOUND HELPFUL IN MAKING DENTAL RADIOGRAMS*

By J. A. Blue, D.D.S., Birmingham, Ala.

THERE are many things that go into making good readable radiograms—that is, radiograms of the proper density to be of real value in diagnosis—and the intention of this paper is to mention a few methods found to be helpful in obtaining the desired results.

Twenty milliamperes with a three and a half to four inch back up and exposure time of from three to five seconds should give the desired density, the films reaching their full development in five to six minutes.

In some cases a preliminary checking of the full mouth can be made using ten films, showing the maxillary first, second and third molars on the first film, the lateral, canine and both premolars on the second film, the central incisors on the third, and the opposite side on the next two films with the teeth as mentioned for the first and second films. For the mandible, the first, second and third molars are shown on the first film, the canine and both premolars on the second, the four incisors on the third and the opposite side on the other two films. Any further checking to complete the diagnosis may be made as needed, the operator being governed by what is shown in the radiograms mentioned above. Don't understand me to say that a complete diagnosis should be made from ten pictures though this can be done, as far as apical areas are concerned, in some cases where all the teeth are vital or where there are only a few pulpless teeth. I believe there should be no limit to the number of radiograms made in a given case, until the diagnostician is satisfied that all suspicious areas have been checked in a way that nothing more can be shown by the radiogram.

Films can be cut to any desired size and shape by taking the stock films into the darkroom and cutting wrapper and film together and binding the edges with ordinary binding, or passe partout, paper. This can be done rapidly by your assistant and a number of sizes cut at one time and kept for

*Read before the American Society of Dental Radiographers at Los Angeles, Cal., July 19, 1922.

use. These odd sizes come in handy in many cases, such as pyorrhea cases, in the mandibular canine region, and in the maxillary and mandibular anterior, in V-shaped mouths, and for children. Duplitized films can also be cut in any size desired. The duplitized films being much faster than the regular and

Fig. 1.—*A* and *b* show the malar shadows interfering with a view of the apices of the molars, which could have been avoided by lowering the tube slightly and directing the rays under the malar bone. In this case there is plenty of room on the film to elongate the teeth sufficiently to eliminate the shadows.

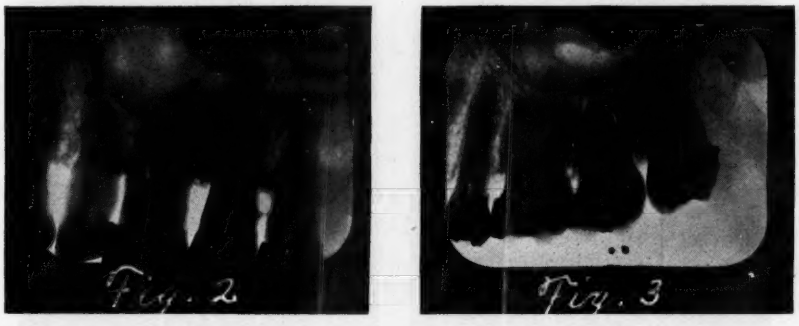


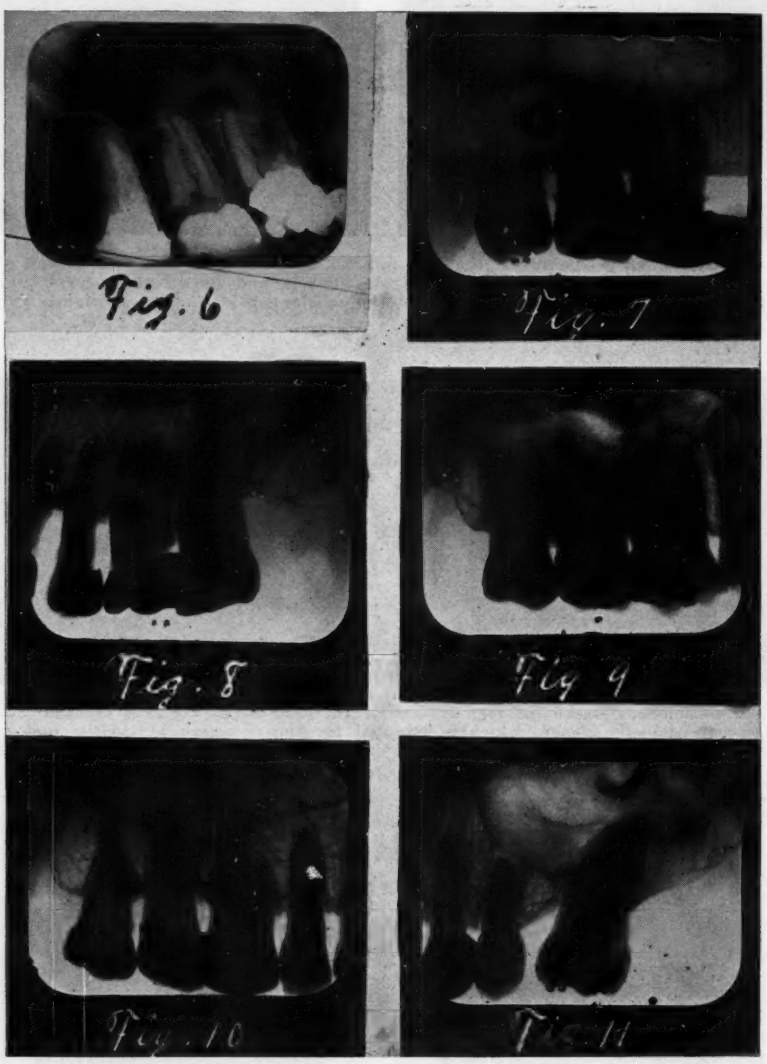
Fig. 2.—The film was placed too high in the mouth. The malar shadows are well out of view but the crowns are not perfectly shown, which is essential for the detection of cavities and contact points.
Fig. 3.—The posterior portion of the film should have been placed higher in the mouth.

Figs. 4 and 5.—These were made with flexible films which accounts for the lack of definition along the upper border which is due to excessive bending.

therefore requiring shorter exposures, are very valuable in the so-called bite picture.

Films should be thoroughly fixed and properly washed in order to have them retain their detail. Living in the south, where the temperature of

hydrant water is high, I have found it advantageous to have an ordinary water keg in which a copper coil has been placed, with the inlet at the bottom and the outlet on the side. This keg is filled with ice to furnish cold water for the washing bath. A galvanized tank was constructed, size 14 × 10 × 6 inches, and a series of holes cut in one side for the overflow at any given point desired, depending on the number of films to be washed. A galvanized tube was placed in the tank to reach and extend across the bottom,



Figs. 6 to 11 inclusive.—These were exposed while being held rigid with a stiff piece of metal attached to their backs. These are in a position which shows the entire crowns as well as eliminating the malar shadows.

the portion of the tube in the bottom of the tank being perforated with a number of holes which were made with a No. 10 bur. A rubber hose connects the tank tube with the water supply leading from the ice keg. The water is allowed to run slowly through this tank for fifteen minutes, at which time the films are free from hypo. The films are then hung in the breeze of an electric fan and allowed to dry. In ordinary weather they will dry in from ten to

fifteen minutes. One set of films is mounted on suitable film mounts so they can be studied when the diagnosis is being made and the other set is placed in an envelope, size 3 x 5 being preferred as they are convenient to handle, and filed in a suitable cabinet for future reference.

The problem of angles must be largely worked out by the individual operator as no set rule can be applied to all cases. There must be some variations—angles must be bisected in such a way that the desired results may be obtained. Some time ago I started out to prove that the malar shadows could be consistently thrown high enough not to interfere with the apices of the roots of the maxillary molars and at the same time use a 17-inch target distance. This can be done in at least 90 per cent, and possibly more, of the cases which are presented. The 10 per cent will compose the cases which have very low arches, and freak cases such as a decided buccal presentation of the cusps and cases of irregularity. It has been found that better results can be obtained by bisecting the angles, using the teeth and palate as a guide, rather than taking into account the position of the malar bone. If the malar process is low and the arch very flat it is impossible to throw the malar shadows off the film without producing root shadows which are too much elongated. It then becomes necessary to raise the tube directing the rays downward, thereby obtaining a view of the palatal root and foreshortening the buccal roots.

A good view of the roots and general position of the maxillary third molar when impacted may be obtained by projecting the rays between the zygomatic arch and the temporal fossa. The tube is raised and tilted back and the rays, directed downward and forward in line with the film, pass through the structures mentioned above, and instead of the zygoma being thrown up, its shadow is cast buccal to the first and second molar crowns.

A QUESTION THAT HAS HITHERTO FLOORED ME

By Howard R. Raper, D.D.S., Indianapolis and Albuquerque

WHEN advocating removal of granulomata as opposed to treating such cases by ionization or cauterization through the canal, it is the common thing for the advocate of the surgery to say: "Show me where, in the whole realm of medicine and surgery, any such treatment is given as that done by dentists through the pulp canal for periapical infection."

Of course the questioner does not expect an answer and I confess the

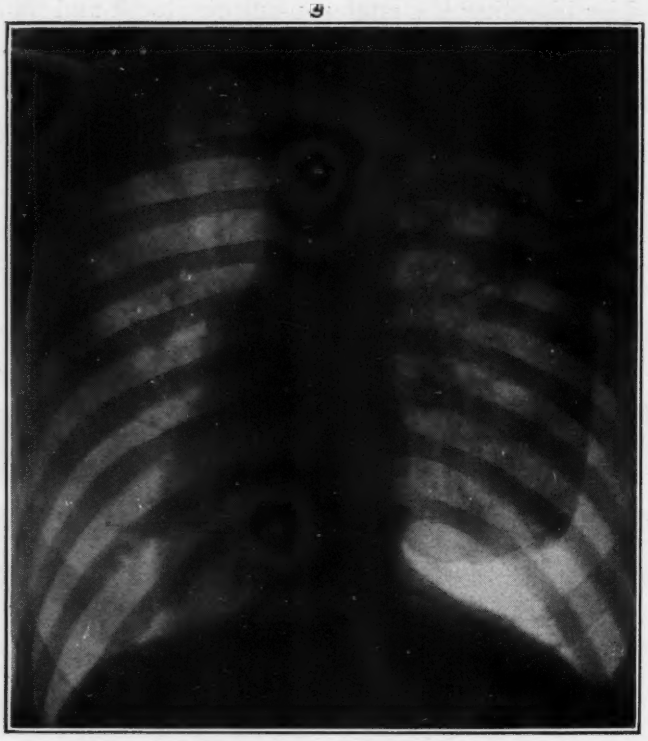


Fig. 1.—The lung on the reader's right is partially collapsed, or compressed, rather, by the pressure of air injected into the thoracic cavity. (This illustration is reproduced by courtesy of the New York Medical Journal and Dr. L. S. Peters of Albuquerque.)

question has, on occasions past, "settled me." But I have recently found an answer; one with a "kick" in it.

When the next 100-per-cent extractionist asks me that question I shall say, "How about artificial pneumothorax in pulmonary tuberculosis?" And then I shall have to explain what artificial pneumothorax is thus:

We have, let us suppose, a case of pulmonary tuberculosis. One lung is in fair or good condition, the other has a pathologic cavity in it—a pyogenic cavity; a pus cavity if you please. Nature is unable to cope with the situation; the patient is dying. Enter artificial pneumothorax. A small hollow

needle is forced between the ribs into the thoracic cavity and sterile air is pumped into the thorax. This operation is repeated once or twice a week or as frequently as judged expedient by the operator until the lung is compressed.

Fig. 1 shows partial compression of the lung on the reader's right. Fig. 2 shows practically complete compression of the lung on the reader's right.

And what becomes of the patient? Well, take Fig. 2, the case of a nurse who was treated, recovered, and has been back at work continuously now for four and a half years. Of course all cases are not so successful as that shown in Fig. 2, but then a really remarkable percentage are successful.

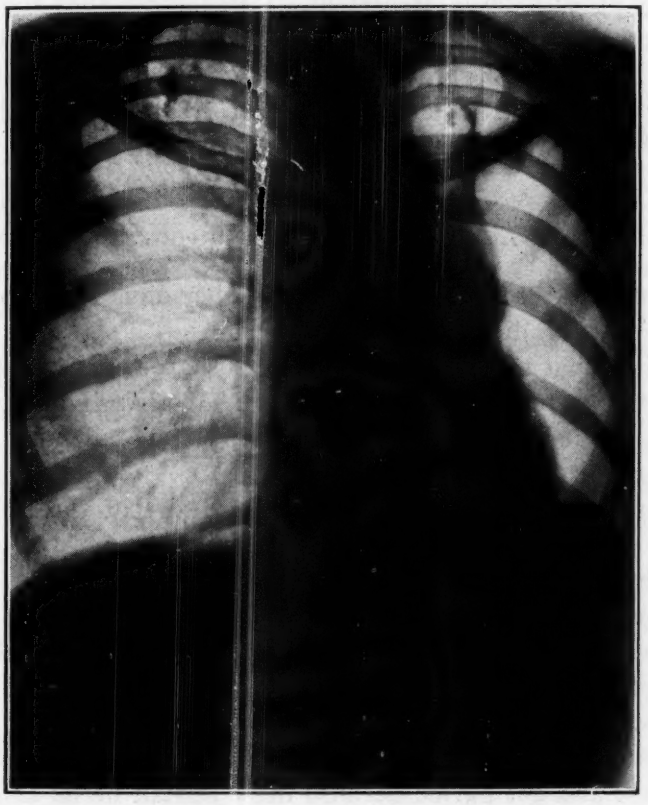


Fig. 2.—The lung on the reader's right is almost entirely compressed (save at the apex) over toward the median line. (This illustration is reproduced by courtesy of the New York Medical Journal and Dr. L. S. Peters of Albuquerque.)

I should say also that this patient (Fig. 2) lives in Albuquerque where the dry air (equivalent in therapeutic effect, it seems to me, almost to a surgical dusting powder) does its share toward giving permanent results in such cases. The prognosis would not be so favorable, if favorable at all, in a moist climate.

But pause, my brother dentists, and see what we have here. A pus cavity as big as a tin cup, not as big as a pea, as is the ordinary pus cavity at the end of a tooth, infected, not only with staphylococci and streptococci but with the tubercle bacillus also; in one of the most vital organs of the body;

with the only possible drainage up hill (as a result of pressure)—*and the case is cured, the patient gets well!*

Here certainly I have shown a case "in the whole realm of medicine and surgery" which is treated successfully without surgical operation at the seat of infection.

The purpose of publishing the foregoing is simply to answer a question I have had put to me repeatedly and which I could not answer before.

I earnestly hope that what I have said will not be accepted as an argument in favor of going back to the treatment of teeth. In the face of such facts as I have set forth I am still *afraid of* the pulpless tooth and I want others to be. I still know that the surgical removal of granulomata is greatly superior to any other form of treatment. I still know that the treatment of the teeth as practiced in the past was a tragic failure and that if, after our vacation from it, we are to go back and treat teeth again it should be a new, better, cleaner (and more expensive) kind of treatment. And above all, I still know that the only solution to the pulpless tooth problem is prevention of the pulpless tooth.

"ISN'T IT TOO BAD?"

"Isn't it too bad," a man said to me the other day, "how the laboratories have *commercialized* radiodontia?"

I agree with what the man meant, but I disagree with what he said.

Why is it wrong to *commercialize* a thing? We live in an age of commercialization. Every instinct, desire, peculiarity, virtue and fault of the human race is commercialized.

The minister commercializes the inherent desire of the human being to be decent and go to heaven.

The merchant commercializes our desire to wear pants.

The medical and dental professions commercialize our desire to be healthy.

The theatrical manager commercializes our desire to be entertained.

The undertaker commercializes our desire to be buried.

And so on.

I am able to go to church, wear clothes, get medical and dental attention, go to the theater and get buried because these human needs and desires have been commercialized.

When men deplore "the commercialization of dentistry or radiodontia" what they really deplore is the corruption of these things by dishonesty, pretense, fraud and misrepresentation.

Of course I agree that "it is too bad" that men do not practice a better grade of radiodontia, that they give false, ignorant diagnoses and that they have cut the price for this inferior service until the very existence of the *art* of radiodontia is threatened.

But what I say is speed the day of intelligent commercialization of radiodontia (and dentistry) and quit misusing the words commercialize and commercialism. Anything for which fees are charged and paid is a commercial enterprise. Intelligent commercialization is the fitting of an honest fee to an

honest service. It is not honest commercialism to sell x-ray negatives and call such service "radiodontic service" or "diagnostic service" and at the same time accuse the few men who are giving genuine radiodontic service of charging excessive fees, when the fact is that such men work for less per hour than the negative vendors.

Putting the right label and price on a thing is sound constructive humanitarian commercialism. A little more of honest labeling in medicine and dentistry could do no harm and would surely do some good.

Radiodontic service may be labeled or designated as follows:

(1) Capable, conscientious diagnostic service for which the fee is based on time consumed and the number of regions examined and the operator assumes the responsibility of making as many negatives as necessary.

(2) Photographic service for which the fee is based on the number of negatives made, such negatives being made at standardized angles.

There is no particular objection to the second class of radiodontic service when it is properly labeled, except insofar as it threatens the existence of the higher type service by its cheapness. (It would be a shame for the real art of radiodontia to die the victim of competition for cheapness, as amalgam and rubber plates died, and have but barely shown signs of regained life these last few years.) But when the practitioners of the second class of radiodontic service pretend also to give reliable diagnoses, giving their diagnoses from *one* negative where *three* should have been made, without pulp testing, and without the studied deliberate consideration of both negatives and collateral evidence so necessary to intelligent conclusions—then there is objection to such practice. Then it is that we have what is commonly called commercialism. But it is not commercialism at all, it is corruption and dishonesty.

RADIOGRAMS

A RADIOGRAM is a wireless message.

* * * * *

A RADIODONTIC examination of any region may be described as one wherein the x-rays have been made to give as much diagnostic information as they are capable of giving.

* * * * *

A SET of ten negatives, such as is so widely used, should be looked upon as a sort of an x-ray *glance* at the mouth. To have an x-ray *scrutiny* of the mouth *begin* with fourteen negatives.

* * * * *

VIEW light negatives by sky light or reflected white light; view dark negatives by strong artificial light; view all negatives in the light of the knowledge that they are only shadows.

* * * * *

THE best stuff I have read recently about radiodontia has been that written by a fellow named Simpson.

A MAGAZINE now before me and opened to the advertising section reveals a nice looking young lady with winsome silk stockings in the act of biting an x-ray machine. Dear Dr. Simpson: Why does the young lady bite the x-ray machine? And when you answer, Doctor, would you mind leaving a little of the hide on?

* * * * *

D. P. N. says that a fellow from back in the sage brush wrote to the supply house asking for bigger films, explaining that the ones formerly supplied were not large enough to enable him to get the ends of the roots.

* * * * *

SOME dentists are beginning to say: "I'm not afraid of pulpless teeth." Auh, aw, look out. The victim is never afraid of the gun he thought was not loaded.

* * * * *

A CERTAIN prominent dentist has been giving lectures over the country and showing radiographs of pulpless teeth, treated quite a number of years ago, which teeth show no evidence of periapical osteoclasia. The insinuation seems to be that these teeth were treated correctly at that time. Of course the mere fact that the teeth show no evidence of periapical osteoclasia only indicates that the teeth were possibly or probably treated correctly; it does not prove it. And wouldn't it be better to admit that if we treated any teeth correctly in the past it was only "by the grace of God," a sort of an accident? If we are to go back to treating teeth, the first thing to do is to admit that the treatment of the past was wrong. This will lead to a search for a new, a better, cleaner, more intelligent, more scientific (more expensive) kind of treatment—*and little of it.*

* * * * *

NOT long ago I made a man very happy, and he made me happy. The man directed my attention to a printed mistake I made several years ago. It made me happy because it gave me the opportunity to correct the mistake. It made the man happy because he doesn't like me very well anyhow.

* * * * *

WHENEVER I use the word radiograph as a noun and submit the work to this magazine I find the word changed to radiogram. But when I use the word radiographic it is not changed to radiogramic. Why not? Of course "radiogramic" sounds silly, but if the word radiograph as I use it is wrong, so is radiographic.

* * * * *

ALSO why call a magazine a Journal of *Orthodontia,* Oral Surgery and *Radiography?* Why use the word orthodontia and reject the word radiodontia?

RADIODONTIC RIDDLES

Conducted by Clarence O. Simpson, M.D., D.D.S.

A Department Devoted to Discussion of the Scientific, Technical, and Ethical Problems of Radiodontia

Success before Service

Q. Will you teach one of my young lady assistants radiography? I have a complete plant, but to successfully run the largest practice in this section I must have the girls do the x-ray and laboratory work.

A. Thanks for the compliment but it cannot be done. An assistant (presumably one without the necessary fundamental knowledge and special training for the practice of dentistry) cannot be taught radiodontia. She may learn to develop films, to manipulate a machine, and to make x-ray "pictures," but she has not the qualifications to make a radiodontic examination. As you have observed, she may learn to mix amalgam, manipulate a dental engine, and polish teeth, but she has not the qualifications to diagnose a case or practice dentistry.

When you employers of "piece-workers" learn that radiodontia consists of much more than films and fees, your patients will begin to derive the great benefits from radiography which your present system will never yield. If your practice is too large for you to do the x-ray examinations and that portion of the laboratory work which should not be entrusted to an unlicensed assistant, why not get a competent associate. True, you would have to share your income or pay a larger salary than the "girls" command, but you would have more self-respect and a better record in the final accounting. A professional practice cannot be conducted like a shop (sweet or sweat) without impairing the service; and quantity production schemes announced for the benefit of the needy, usually operate for the benefit of the needy doctor.

Your reference to the "plant" and successful practice invites discussion of this growing tendency to pageantry and chicanery in dentistry. Your words unmistakably proclaim that you have one of those cunning catalogue offices with a "cuckoo-window" in the reception room where the "birdie" pops out, an illuminated sterilizer display more impressive than your chain of asepsis, some over-stuffed rose or turquoise carpets, a time-stamp, and a special cabinet for drinking glasses. Have your operations improved like the "old stand"?

The greatest travesty on dentistry as a scientific profession is an ornate booklet distributed by one of the equipment monopolies which portrays the

salesman's idea of a successful dentist. It reeks with business psychology, superficial efficiency, and time payment ostentation. It describes lavender scented operating rooms with the daily floral offering, the sales talk with the patient placed at a disadvantage facing the light and below the "psychologist," and the gowned, freshly manicured operator anointed with rose water. The illustrations show a "model" suite combining all the pastel shades of a calciminer's nightmare in a space of 22 x 26 feet divided into ten rooms (?) and a hall, dust collecting valance drapes in the operating rooms, and a marcelled Apollo in a night shirt transilluminating a Venus surrounded by mirrors. The legend writer states "Trans-Illumination * * * is an effective way to enthuse the patient on the influence of good dental work on the general health," which is important if true but as superfluous as the hyphen and capital injected into "transillumination."

By the shade of Oscar Wilde, has dentistry lapsed into an esthetic decadence wherein the vogue is a perfumed rendezvous of sensuous colors, the practice the theatrical trickery of a fakir, and the practitioner a cosmetic addict with a handkerchief in his cuff consorting with man milliners? If drastic steps are not taken to curb the aggression of the commercial interests in their educational (?) campaigns, nostrum hawking, and practice veneering, dentists will soon be subcontracting for them and wearing advertising insignia like refreshment vendors.

That beloved exponent of dental science and ethics, Dr. C. N. Johnson, wrote a monograph on "Success in Dental Practice" which has served as an inspiration and guide to many illustrious practitioners of the present generation. He nobly selected humanitarian service for his theme, and leavened it with sufficient system and business acumen for economic balance without subordinating professional precepts.

Read it, boy, and get back to the principles to which you ostensibly subscribed when you appropriated the accrued knowledge of a learned profession. Then you will not choose to profit from the incompetent operations of an unqualified assistant.

ABSTRACT OF CURRENT LITERATURE

Covering Such Subjects as

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA — DENTAL RADIOGRAPHY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Encephalitis Following Extraction of a Tooth with Infected Apex. H. A. Potts (Chicago). The Dental Summary, June, 1922, xlii, 6.

The patient, a woman of forty-two, consulted her family physician on November 12, 1920, for vague symptoms—nervousness, palpitation, dyspnea, and slight trembling on exertion. The condition had existed several years and she had lost flesh. Physical examination was chiefly negative, but an x-ray of the teeth showed several apical infections and it was proposed that these teeth be extracted. An upper right second bicuspid was taken out on November 26. There had been no symptoms, aside from the x-ray shadow, to inculpate this tooth, and the granuloma came away with the latter. Local anesthesia was employed and the extractor was a careful and competent dentist. There at once followed a syndrome suggesting surgical scarlet fever which, however, was excluded by the course, the rash soon vanishing. By December 4 the temperature had become normal, the leading symptom being soreness of the nuchal region. This was succeeded by a general convulsion lasting 10 minutes, opisthotonus and a sudden rise of temperature to 106°. Lumbar puncture was negative. Patient became delirious and comatose but rallied and by December 8 seemed out of danger. In discussion Blair of St. Louis stated that he had seen a dozen deaths following extraction, but in every case the extraction was done during an exacerbation of acute infection. In the above case the inference is that some of the bacteria had been mobilized at the root of the tooth and had escaped into the circulation. The picture was of course highly atypical as far as intracranial infection is concerned.

Fifty Years' Observation of Oral Surgery. T. L. Gilmer (Chicago). The Journal of the National Dental Association, July, 1922, ix, No. vii.

The author refers to the rôle of Garretson as the pioneer oral surgeon. The latter visualized a course of instruction open alike to the dentist and surgeon, but later developments made this branch of the healing art inseparable from dentistry proper. It represented advanced dentistry and not an

integral part of general surgery nor a separate surgical specialty. It is abundantly evident that the term "oral surgery" is a complete misnomer, and that the correct expression is "dental surgery." Surgeons exist who limit their work largely to operations on the mouth, face and jaws, and such practitioners often have no dental training, neither does their province coincide with that of the oral surgeon. Another type of the dental surgeon is the man with the double degree who is naturally especially qualified for all surgery involving the oral cavity. A third type is the dentist without medical training who takes up oral surgery. Garretson's successor in the University of Pennsylvania, Professor Cryer, introduced the Bonwill surgical engine for bone drilling, etc., and the principle has been extended to all forms of local bone surgery. The dental surgeon is also responsible for nitrous oxide oxygen anesthesia, and in part for the ether vaporizing apparatus; and again for the suction apparatus for removing blood from the operating field. Dental surgeons are also to be credited with the best modern technic for treating fractures of the jaws and for standard cleft palate operations. So-called surgical orthodontia is not an outgrowth of dental surgery but the credit or discredit of it should be awarded to the extraction specialist. The dental surgeon, odd to relate, is not a sponsor for this practice and is even distinctly opposed to it when there is any possibility of disseminating the infection.

Oral Surgery, A Department of Gastroenterology. J. W. Draper (New York). Reprint of an article in the Medical Record, March 11, 1922.

Medicine having subdivided indefinitely into specialties, a countermovement in the direction of integration will eventually be inevitable, and some of the narrower special fields will be regrouped to form larger ones. The author points out that rectal specialists no longer limit themselves to the rectum, while exclusive stomach specialists have also passed out. Both types claim the intestine, for the small intestine originally claimed by the gastroenterologist can hardly be thought of apart from the colon, while the rectal man will hardly stop at the colon. The stomach man has long claimed the esophagus as part of his field and it seems inevitable in the author's viewpoint that oral surgery must eventually be absorbed in one grand field which embraces the entire alimentary canal. There are some stumbling blocks to this conception. Thus the gastroenterologist has been preeminently a physician or internist, all operations on the gastroenteric tract having belonged to the abdominal surgeon. He has been interested in curing diseases by nonsurgical means, and the surgeon is his competitor. The proctologist on the other hand is essentially a surgeon who dips at times into abdominal surgery—colostomies and the like. Abdominal surgeons have in many cases absorbed much of the knowledge of the medical gastroenterologist, and by the aid of the chemist and radiographer can make their own diagnoses of gastric disorders, but the reverse is much less frequently seen and the man who begins as a gastroenterological internist will hardly evolve into an abdominal surgeon. The author thanks the progressive dentist for the sup-

port of his own thesis and even seems to give him credit for priority in the demonstration of the fact that dental pathology is interlocked with the pathology of the stomach and colon. For years he has been curing intestinal maladies by treating the mouth and antrum. While the evolution of the teeth was a step of great importance for the welfare of the body at large a new crop of diseases resulted and this dualism for good and evil is seen in all evolutionary advances; so that if we wish to grasp the nature of disease we have chiefly to study these advances intensively. The diseases in this instance are of the infectious type with especial reference to the activity of the familiar exciters of suppuration. They are due to a break in the natural defenses. The teeth enable us to utilize as foods many hard and raw articles of diet but they facilitate ordinary infection. According to the author all benefits derived from mastication are far inferior to the damage done by oral infection. The tonsils, believed to be an integral part of the lymphatic line of defense against entrance into the blood of microorganisms themselves often suffer directly, and moreover a certain amount of toxemia and infection is not prevented. The colon through a variety of accidents, due in part to assumption of the upright position and in part to sedentary life, becomes a third alimentary canal source of infection and toxemia, and in many cases there is neither pain nor fever nor any other familiar symptom to point towards the source of the mischief. It is this element of focal infection which brings together the various segments of the alimentary canal in one special discipline of surgery and to the preceding the appendix and gall bladder could doubtless be added.

Unity of the Different Forms of Paradental Cysts. Delater and Bercher (Val-de-Grace). La Revue de Stomatologie, May, 1922, xxiv, 5.

The authors relate in detail seven cases of paradental cyst and reach the following conclusions: There is evident a relationship between the malpighian epithelium of Case I and the adamantine epithelium of Case III, while in Case II both types are seen in the same cyst. The paradental epidermal debris is very probably the same tissue at different stages of development. In Case III the cells which spring from the embryonal epithelial layer have reached the age of the cells of the adamantine organ, while in Case I development of the same cells has been checked by the appearance of the process ending in cyst-formation. In Case II some of the cells had their growth arrested while others went ahead to the adamantine stage. The common origin of the two types of cell had already been noted by Roussy and Leroux in their work on the diagnosis of tumors and also by Chibret. The former authors state that both dentigerous and nondentigerous cysts are constituted of star-shaped malpighian cells and Chibret explains the differences by the intercurrent development of a tumor during the normal evolution of the cells.

In other words all paradental cysts have a common origin in epithelial tissue. Coryllos, it will be remembered, also regarded paradental cysts as simple fluid adamantinomas. The paradental cyst then is of malpighian, adamantine or mixed epithelial origin, while a transition may be seen be-

tween the adamantine layer and the anarchic invasion of the wall suggesting epithelioma. Finally the paradental cyst may be infected and undergo inflammatory cystic degeneration.

Is Sugar the Main Cause of Dental Caries? A. Parlin (Chicago). The Dental Cosmos, July, 1922, lxiv, 7.

This question cannot yet be answered intelligently and will not be so answered until special research has been instituted. The sugar hypothesis of the cause of caries is of course part of the larger problem of carbohydrates and caries. It is easy to demonstrate that caries increases with the per capita increase of sugar consumption, but this argument may be highly fallacious. Every dentist may contribute something by studying his own patients from this angle. He might use cases in which there is very slight consumption of sugar to control those in which sweets are eaten in moderation or excess. If we find plenty of caries in those who ignore sweets the fact would be of great significance. In studies of caries from this viewpoint various elements would have to receive due attention. One is racial, for it is known that caries is very largely a white man's disease. That negroes may constantly eat sweets and not develop caries is due chiefly to the fact that the negro, especially in a primitive state, is relatively and racially immune to this disease: although he can acquire it by following closely the white man's mode of life. Another factor is the spontaneous tendency of caries to undergo relative arrest after childhood and adolescence have passed. The problem would therefore have to be studied in relatively early life.

Pyorrhea Alveolaris. Scherbel (Leipzig). Zahnaerztliche Rundschau, May 23, 1922, xxxi, 20.

The author quotes the view of Roemer that this affection begins with inflammation of the gum, which first destroys the circular ligament, causing the formation of the gum pocket and the destruction of the alveolar process, which is then replaced by fibrous tissue. Pyorrhea and formation of granulation tissue are collateral phenomena. Others see as the first step in the disease atrophy of the alveolar process and regard the disappearance of the circular ligament as unessential. The author is antagonistic to the practice of studying the pathology of this affection on the cadaver. Only experiments can throw light on its nature, and these must of course be made on animals. The task is a most difficult one and we do not know, at the very outset, whether we have to do with a single disease or group. The latter seems more probable. The possibility of finding a single disease exciter is very remote. Disease, as stated by Hufeland 125 years ago, is made up of two set of phenomena, viz.: the action of causal factors on the organism and the reaction of the latter upon the causal elements. This axiom we too often forget, for what we call the disease is made up of both elements—action and reaction.

Recently two papers appeared which cover respectively the occurrence of the affection in dispensary or walking, and bedridden cases. Both classes

presented pyorrhea and loose teeth but hardly anything else in common. It is common observation that pyorrhea often disappears as soon as there is recovery from the basic disease, and the latter may be almost any chronic general condition.

Certain Nose and Throat Conditions Allied to Dental Problems. H. M. Hayes (New York). Eye, Ear, Nose and Throat Monthly, July, 1922, i, 6.

Within the past decade there has been noted a marked degree of *rapprochement* between the dentists on the one hand, and the various medical specialties on the other. This is especially the case with the rhinolaryngologist. The war played an important part in the interchange of ideas, and focused and stressed the relationship between general medicine and stomatology. But thus far the dentist is not in touch with general medicine in the sense that the rhinologist is—thus the latter has a Wassermann made about twenty-fold as often as a dentist. The latter is at a disadvantage in cases of unhealed fistula or sinus which are often of syphilitic origin, although only the Wassermann reveals this fact. In regard to the evils attributed to focal infection, the author finds this doctrine just as broad as it is long, or in other words, half the teeth are wrongly removed, and half the teeth undrawn ought to be drawn.

The dentist is often in position to single out the case in which adenoids or enlarged faucial tonsils are a source of mischief and in any doubtful case the presence of enlarged cervical lymphnodes is evidence that the focus should be extirpated. He should not, however, promise too much in these cases, for after removal of these lymphoid structures the subject may show no immediate improvement. It is enough to call attention to these possibilities and leave the rest to time save in certain cases. When there is a continuous recurrence of acute tonsillitis, removal may be positively ordered, and this also holds good if hearing is threatened. In all borderline cases the presence of enlarged cervical lymphnodes may turn the scale. The rhinolaryngologist, on the other hand, has abundant opportunity to urge his patients toward spreading the jaws, although it must be borne in mind that this must be undertaken at a very early age period—usually long before the patient seeks rhinological care.

The Rhodesian Skull. C. E. Johnson (Madison, Wis.). The Dental Cosmos, July, 1922, lxiv, 7.

Discoveries within comparatively recent years of very ancient skulls in various parts of the world should be of special interest to the dentist from more than one angle, but according to the author's experience little or nothing has been found on the subject in the American dental journals. In the South African skull the retreating forehead and prominent supraorbital ridges suggest the ape but the teeth are human throughout and the shape and size of the palate suggest the gift of speech. The maxillary teeth are arranged in a horseshoe pattern and all teeth are badly worn, the anterior

down to the neck. The incisors occlude end to end as in all primitive skulls. Despite this fact the teeth show signs not only of caries, especially in the molars and premolars, but of pyorrhea or alveolar abscess as well. This skull then differs from the general run, for primitive man has in general been held to be quite free from caries, even up to comparatively modern times—say 2000 years ago. Not much could be learned of the mandibular teeth owing to the imperfections of the skull. As for other ancient skulls the Java ape-man's remains included but a single tooth, a third molar, which is simply classed as primitive with two buccal roots fused; the Heidelberg man has a powerful mandible of mixed human and simian traits and the same may be said of the Piltdown man. Simian characters are also in evidence in fossil men of later periods, but in the Aurignac and Magdalen fossils despite their relative antiquity the teeth are practically human.

On the Relation Between Buccal Infections and Constitutional Disease. H. S. H. Leichtenstein (Munich). Zahntechnische Reform, April 9, 1922, xxvi, 14.

Since a pamphlet by Fisher, the physiologist of Cincinnati, on the above subject, has been translated into German, the German dentists and medical men have shown much interest, the majority regarding the supposed causal relationship as not scientifically demonstrated. The present author concedes the importance of study of the subject which must be based on x-ray findings. The crux of the entire discussion is the answer to the question "Is a tooth with dead pulp to be looked on as practically a sequestrum?" The use of arsenic to devitalize pulp is involved and there is no doubt that the mineral may, through its deep action, not only devitalize the entire pulp but act further by attacking and devitalizing the periodontium through the apical foramen. Total arsenical necrosis of the periodontium is seen almost daily by the busy dentist in connection with extracted teeth. At present we have no way of determining the depth of the action of arsenic. The use of the latter should be cut down in the opinion of the author who mentions as a substitute procedure removal of pulp under local analgesia. This is a common and successful method in dealing with the lower molars. Aside from the overuse or misuse of arsenic and the substitution of direct excavation of pulp under novocain, the subject resolves itself into a matter of ordinary asepsis, in dealing with root filling, etc., and this is desirable in any case irrespective of focal infection possibilities.

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EDITORIALS

The Place of Orthodontia in School Dentistry

THE British Dental Journal of April 1, 1922, contains an original communication under the above title written by R. Weaver, School Dentist to the County Borough of Derby. The article contains many points of interest, some of which we agree with; other statements we are not sure we understand. Whether we entirely agree with the author of the article or not, it is being published in full in this issue of the Journal, because it deals with conditions which will have to be considered sooner or later in this country.

We are all agreed that orthodontia has a certain place in the school clinic, as such clinics are being organized in this country. It seems as though the British Government is also approaching the relation of dentistry to the people in some manner similar to the school clinics that are being established

here. Just exactly what the relation of orthodontia to school clinics will be, is a question difficult to decide. We are aware that there are an increasing number of people who believe that medical and dental services should be paid for by the state. Just exactly how far this socialistic view should be carried and to what extent the public health movement should be backed by the government in relation to the general public are problems that will have to be solved in the future.

There is no doubt that the people are entitled to a certain amount of public health service, also a certain amount of dental attention in the school clinic. However, we are not convinced at the present time that all kinds of dental operations should be performed in school clinics, including the most expensive types of dental restorations as well as the correction of all types of malocclusion.

There is no doubt but that certain cases of malocclusion should receive attention, and information relative to the orthodontic needs should also be given. At the present time, however, and probably it will be many years before conditions will be different, it is impossible to treat all types of malocclusion that are seen in the public school clinics. We have never had experience in public school clinics, but we have come in contact with the public through our association with orthodontic clinics in dental schools. There is a certain class of people who realize the value of orthodontic services, who try to convince us they are entitled to a consideration. In other words, if it were possible, they would insist the public bear the burden of having orthodontic services rendered to their child. There is no denying that a case of malocclusion makes the teeth more susceptible to caries and also does not allow the child to masticate properly. Realizing all of this, we must remember that the amount of time and expense necessary to correct the average case of malocclusion makes the treatment in the public school clinic an absolute impossibility.

In the dental college clinic, we meet a certain class of individuals who appreciate the importance of orthodontic service and realize that the correction of malocclusion will result in great facial improvement. We learn that some of these people have consulted private practitioners and have found that the correction of the malocclusion would entail considerable expense. They then try to make the dental college clinic carry that personal burden. These people are probably the same type Mr. Weaver has referred to in his article in the *British Dental Journal*. They seem to believe that the public owes them a certain consideration. In other words, that medical and dental services should be paid for by the commonwealth, regardless of the fact that we find these individuals dressed entirely out of keeping with people who are expected to receive a charity. In instances investigated, we find they are engaged in profitable businesses and receiving incomes much larger than a great many men engaged in the private practice of dentistry.

The present dental college clinics are not run as charitable organizations, but as teaching institutions, consequently it is our belief that in a dental college clinic only such cases of malocclusion should be treated or

attempted as are necessary in the proper instruction of the subject. The conducting of an orthodontic clinic in a dental college for the purpose of financial gain or in order to see how many cases can be treated or with the idea of making a charitable institution is entirely wrong. Coming, then, to the public school clinic, it is almost impossible to take care of malocclusion because of the necessary time involved and the expense which would make it prohibitive on the part of the commonwealth.

A public school clinic supported by the Board of Health or the Board of Education should not attempt to treat any case of malocclusion, even such malocclusion as suggested by Mr. Weaver in his article. It is our opinion that advice only should be given the parent. It is undesirable even to treat extreme cases of facial deformities in a public school clinic because of the change of management in such a clinic, plus the fact that the patient is liable to change location before the case is completed.

Orthodontic privileges paid for by the commonwealth are absolutely impractical. The expense necessary for the correction of a case of malocclusion would be so great as to be entirely out of proportion for services rendered in other lines of public health from which a greater number would derive benefit. In making this statement we do not belittle the benefit of orthodontic treatment, but we know from experience that the expense involved would be much greater than would be concurred by providing health service to a great many more individuals in other departments. It was found by actual experience in a large nose and throat hospital where an orthodontia clinic was held a few years ago that it cost as much to render orthodontic services to one individual for a year as it did to treat forty cases suffering from adenoids and diseased tonsils. As a result of this disclosure, the orthodontic clinic was discontinued.

Public school clinics should devote their time to giving information regarding orthodontic treatment, calling the parent's attention to what should be done rather than attempting to render actual orthodontic service. We also believe that such treatment as suggested by Mr. Weaver in his article would, in the majority of cases, be a detriment; the child would be much better if no such type of treatment was attempted. The problem is one which will come up for a definite solution and will have to be met in the near future in our own country.

ORTHODONTIC NEWS AND NOTES

American Institute of Dental Teachers

The Thirtieth Annual Meeting of the American Institute of Dental Teachers will be held at Creighton University, Omaha, Nebraska, Hotel Fontenelle, headquarters, January 22, 23, 24 and 25, 1923.

A cordial invitation is extended to all persons interested in dental teaching. A. H. Hipple, President. Abram Hoffman, Secretary, 381 Linwood Ave., Buffalo, N. Y.

Institute of Oralogy

Out of town members of the medical and dental professions are extended the privilege of the Institute of Oralogy offices, 587 Fifth Avenue, New York City, for consultation and examination of any of their visiting patients.

The Tennessee State Dental Association

The Fifty-Sixth Annual Meeting of the Tennessee State Dental Association will be held in Nashville, Tennessee, May 2, 3, 4 and 5, 1923, with headquarters at the Hermitage Hotel. A clinical and scientific program of unusual interest is being arranged. O. A. Oliver, President. Joe Minor, Secretary, Lambuth Bldg., Nashville, Tenn. J. W. Winn, Chairman Program Committee, Lambuth Bldg., Nashville, Tenn.

American Academy of Applied Dental Science

The Fourth Annual Meeting of the American Academy of Applied Dental Science will be held at Miami, Florida, January 8, 9, 10 and 11, 1923.

All ethical students of progress in both the medical and dental professions are invited to take this short course in Oralogy-Health Dentistry. Papers, clinics and some educational classes free.

For information write Convention Headquarters American Academy Applied Dental Science, Congress Building, Miami, Florida, or Chamber of Commerce, Miami, Florida. Dr. H. L. Madison, Cor. Sec., Burlington, Ia.

Notes of Interest

Dr. Harry L. Hosmer announces the removal of his offices to 1211 Stroh Building, Detroit, Mich. Practice limited to orthodontia.

Dr. Barney B. Kennedy announces after November first his practice will be limited to orthodontia, 509-11 Century Building, Jackson, Miss.